The MINING CONGRESS JOURNAL

Volume 16 SEPTEMBER, 1930 No. 9

In This Issue

The Silver Situation

Gold Production and Its Future

Annual Western Division Meeting at El Paso

Mining Methods at the Engels Mine

Concentrating Tungsten Ore at the Nevada-Massachusetts Mill

Mining Fluorspar at Rosiclare, Illinois

Safety Achievements of a Pennsylvania Coal Mine

The Safety Court of the Harlan Fuel Company

The Fallacy of Arguments Against Mechanized Loading

Contributors

Francis H. Brownell, H. A. Kursell, W. I. Nelson, Ott F. Heizer, Edwin C. Reeder, Francis Feehan, Charles S. Guthrie, G. B. Southward

CARELESSNESS - - - DOES MORE HARM THAN WANT OF KNOWLEDGE

B. Franklin

Practically no coal was mined in America when Benjamin Franklin lived, but if he were living today he could make no truer statement regarding the causes of accidents in coal mines then that quoted above.

Conscientious mine officials and mine inspectors do their part so well in instructing mine workers that comparatively few are ignorant of proper procedures —but many fail, through carelessness, to observe them.

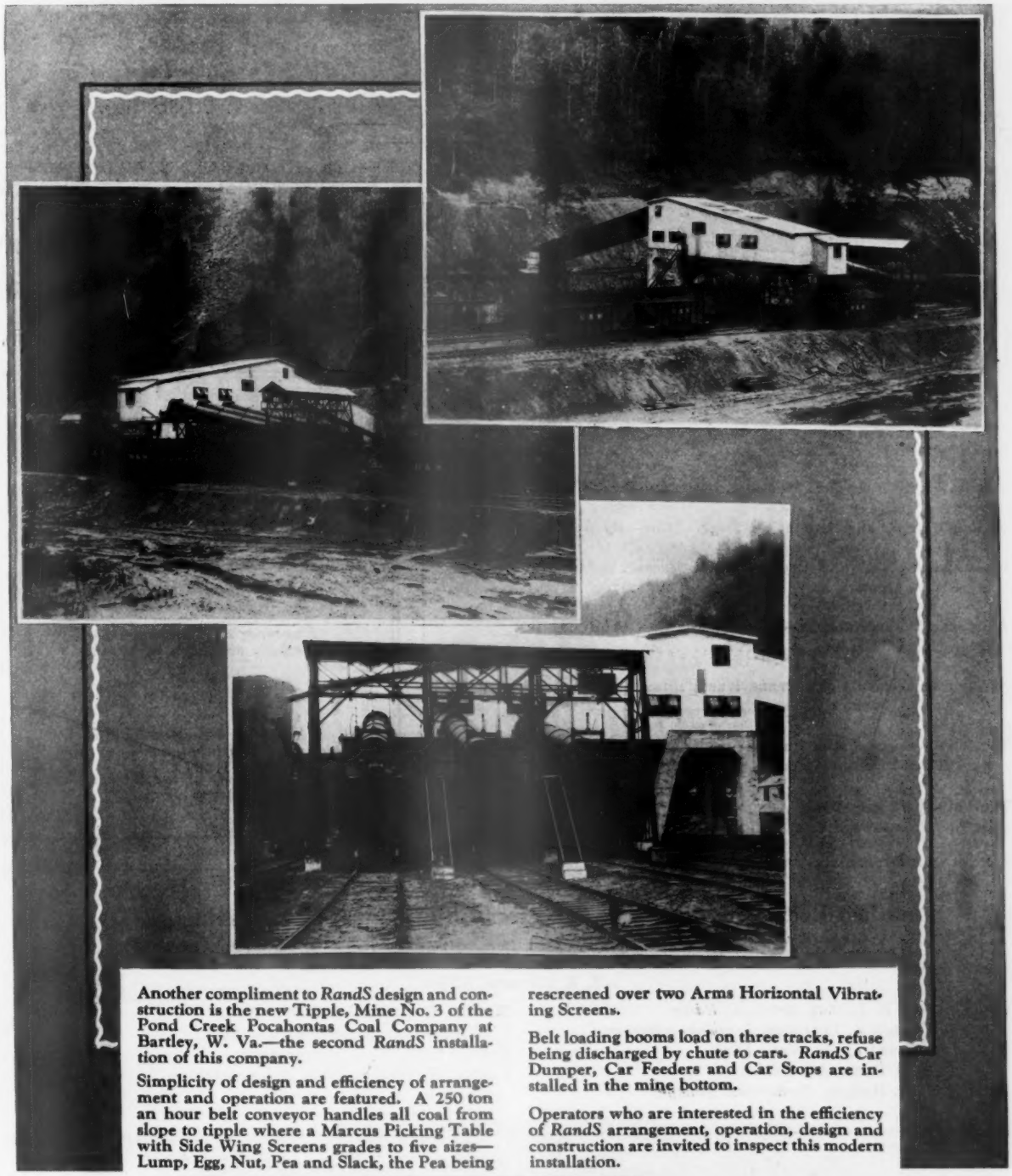
As manufacturers of safety fuse we have devoted nearly a hundred years to the development of material and methods for making blasting an inherently safe operation—when proper procedure is observed —and we pledge our fullest cooperation to those whose days (and often nights) are spent in combating carelessness among mine workers!

THE ENSIGN-BICKFORD CO.
SIMSBURY **CONNECTICUT**

Do Not "Short Fuse" --Fuse should be cut long enough for the end to extend well out of the mouth of the bore hole when the primer cartridge is in place.
All holes should be well tamped.

THE ENSIGN-BICKFORD CO. 1836 SAFETY FUSE 1930 SIMSBURY, CONN.

Pond Creek Pocahontas Coal Company's Bartley, W. Va., Mine No. 3 Is Completely RandS



Another compliment to *RandS* design and construction is the new Tipple, Mine No. 3 of the Pond Creek Pocahontas Coal Company at Bartley, W. Va.—the second *RandS* installation of this company.

Simplicity of design and efficiency of arrangement and operation are featured. A 250 ton an hour belt conveyor handles all coal from slope to tipple where a Marcus Picking Table with Side Wing Screens grades to five sizes—Lump, Egg, Nut, Pea and Slack, the Pea being rescreened over two Arms Horizontal Vibrating Screens.

Belt loading booms load on three tracks, refuse being discharged by chute to cars. *RandS* Car Dumper, Car Feeders and Car Stops are installed in the mine bottom.

Operators who are interested in the efficiency of *RandS* arrangement, operation, design and construction are invited to inspect this modern installation.

ROBERTS AND SCHAEFER CO.

ENGINEERS and CONTRACTORS

PITTSBURGH, PA., 418 OLIVER BLDG. WRIGLEY BUILDING, CHICAGO HUNTINGTON, W. VIRGINIA, 514 NINTH AVE.

THE MINING CONGRESS JOURNAL

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METAL

Mining Methods and Costs at the Engels Mine

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COAL

Safety Achievements of a Pennsylvania Bituminous Coal Mine

The Safety Court of the Harlan Fuel Company

Published Every Month by The American Mining Congress, Washington, D. C.

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ROEBLING

"BLUE CENTER" STEEL WIRE ROPE

Wire Rope Should be Appraised on the Basis of Service

Wherever better service is desired Roebling "Blue Center" Steel Wire Rope is proving its superiority. It is strong; tough; dependable; and gives long, satisfactory life in service—*and it is service that counts!* The long service of "Blue Center" reduces the number of replacements and every mining operator knows the annoyance, expense and retarded production caused by replacements. All of which conclusively proves that Roebling "Blue Center" is the most economical rope to buy.

Made in constructions and sizes particularly adapted to your requirements.

"BLUE CENTER" STEEL WIRE ROPE

John A. Roebling's Sons Co. Trenton, N.J.

JEFFREY 44-C

The Loader You've

Jeffrey's newest achievement, the 44-C Loader, promises to revolutionize loading practice. It is what you have been looking for—an efficient, ample capacity loader at a moderate price.

It operates with any mining method. Shortwall, longwall or arcwall systems make no difference to 44-C. Its installation requires no change—does not render other machinery obsolete.

In operation, the gathering head in front sweeps about, pulling the coal into the conveyor which, in turn, loads it into cars.

This sweep does such a complete job that extra clean-up men are unnecessary. What little cleaning up is required is done by the loading crew as the machine works.

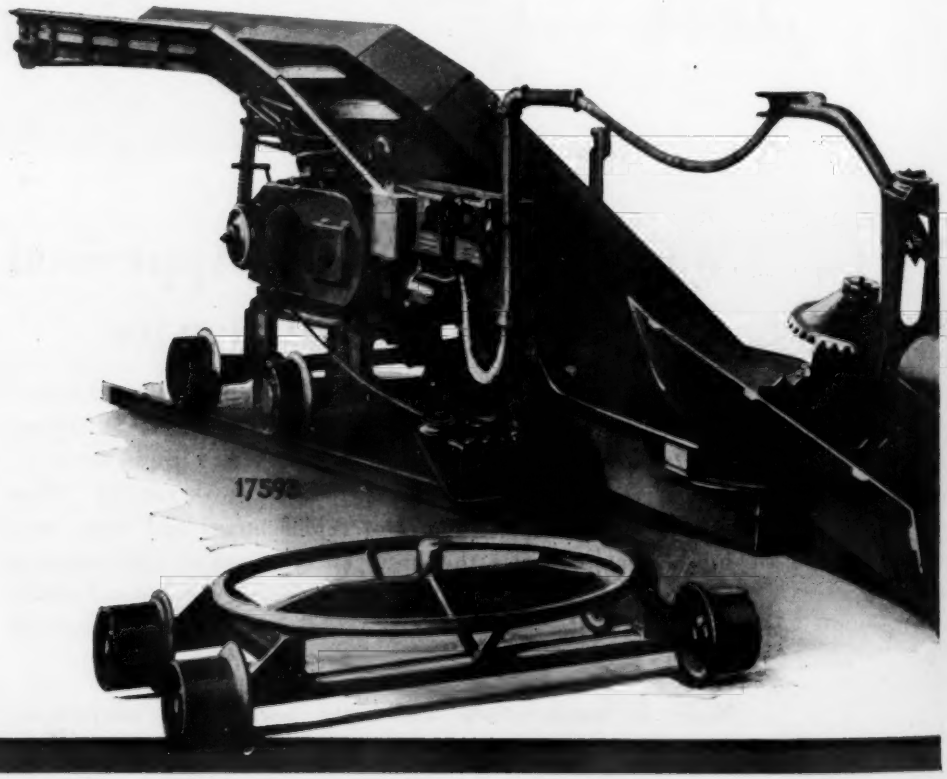
Work is untroubled by poor roof, as you can timber close to the face.

44-C is pictured here in the loading position. When tramming the removable pony truck, shown at the side, supports the gathering head. Both loading and tramming operations are easy and simple.

The design is simple as you see. Construction is exceptionally sturdy. Hence maintenance costs are very low. No special attention is required on the off shift for preparing the machine for the succeeding loading shift.

Average power demand is 5 to 7 H. P.—both maximum demand and energy charges are low.

Capacity makes machine loading worth while—initial investment is very low. Investigate this loader—write Jeffrey for Bulletin 503-C today.



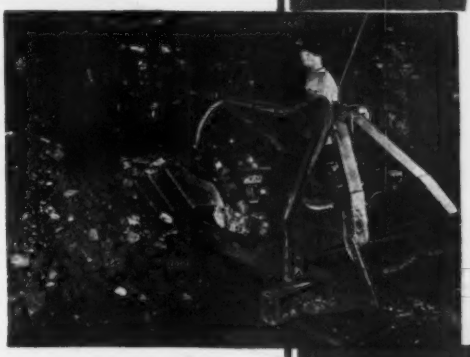
The Jeffrey Manufacturing

Locomotives - Cutters - Drills - Conveyors - Fans - Tip

COLUMBUS, OHIO

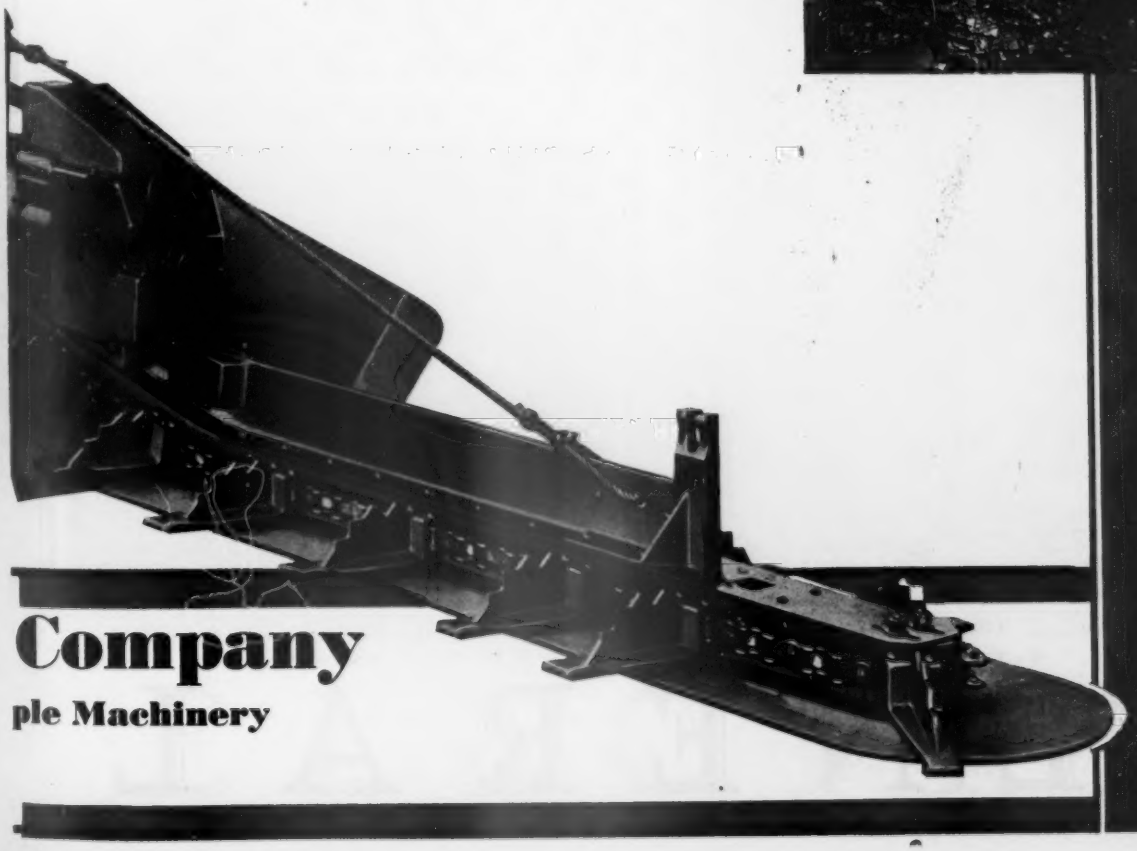
Been Waiting For

JEFFREY 44-C



Low First Cost—
Plenty of Capacity—
Low Power Consumption—
Low Maintenance

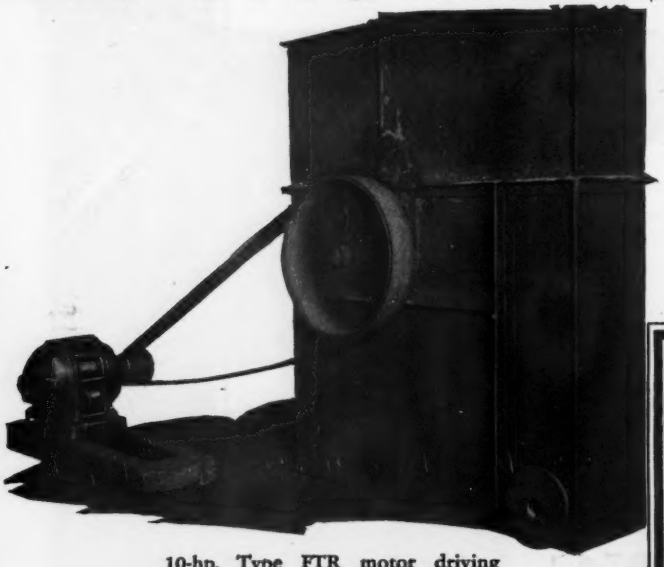
FOR ANY MINING SYSTEM



Company

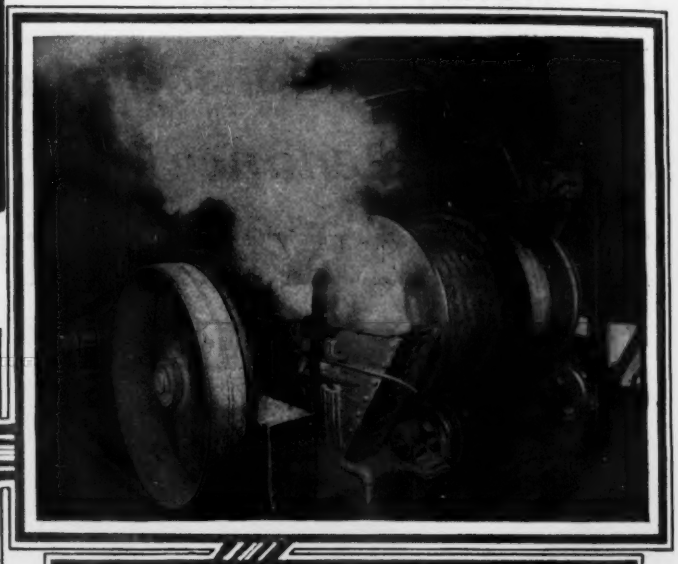
ple Machinery

In the Sinter Plant

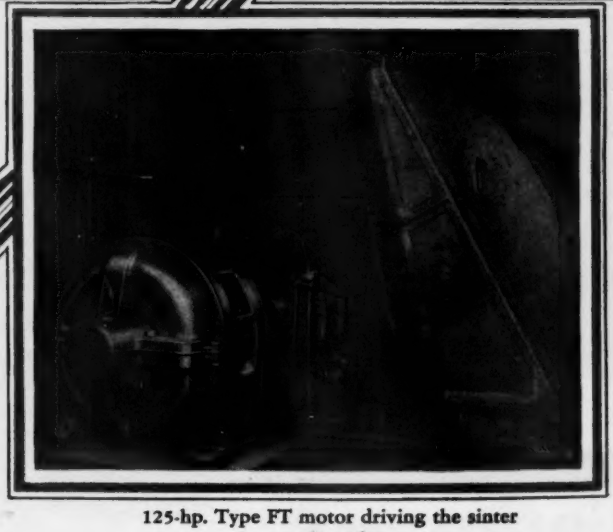


10-hp. Type FTR motor driving bucket elevator at top of sinter plant

10-hp. Type FTR motor driving pug mill



10-hp. Type FTR motor driving conveyor at delivery end of sinter machine



125-hp. Type FT motor driving the sinter machine fan

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

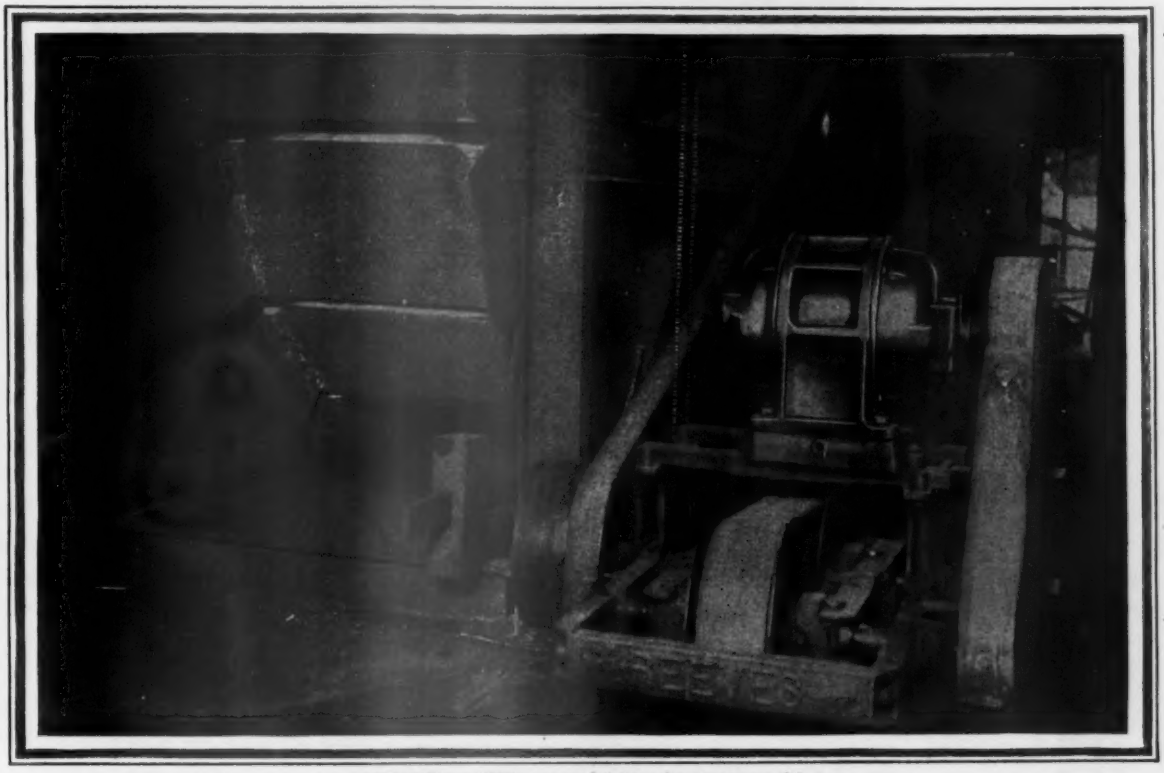
G-E Motorized Power Assures Dependable Operation

FOR example, in this 200-ton sinter plant of the Ducktown Chemical & IronCompany, at Isabella Tenn., sintering goes on 24 hours a day, 365 days a year; and fine, abrasive sinter dust is everywhere. Despite these conditions, standard, open-type G-E motors have given perfect service for over two years—with not one breakdown, not one cent spent for repairs.

Every motor in the plant, except the fan motor, is a "Type FTR"—the G-E high-starting-torque motor which draws low current at starting, thereby permitting simple, across-the-line control.

Not only for sintering but for every process in the mining, milling, smelting, and refining of metals, the selection of G-E Motorized Power assures the correct type of motor and controller for every duty and every condition.

Motorized Power
—fitted to every need



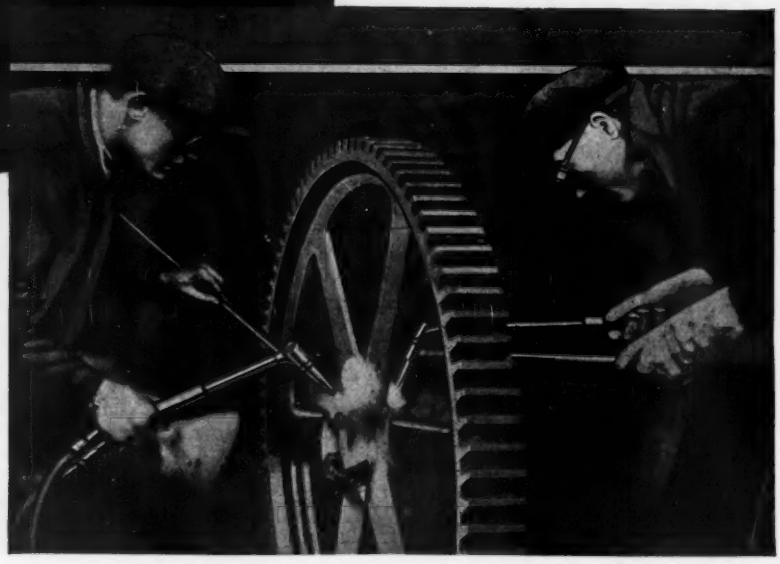
10-hp. Type FTR motor driving the sinter machine

200-379

ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

THE FOE OF INDUSTRIAL WASTE



MILLIONS of dollars of capital are dissipated yearly in discarded machinery and equipment. This figure would be many times as large but for the use of oxy-acetylene welding in the repair and maintenance of plant machinery. Much more can be saved by still broader application of the oxy-acetylene welding process.

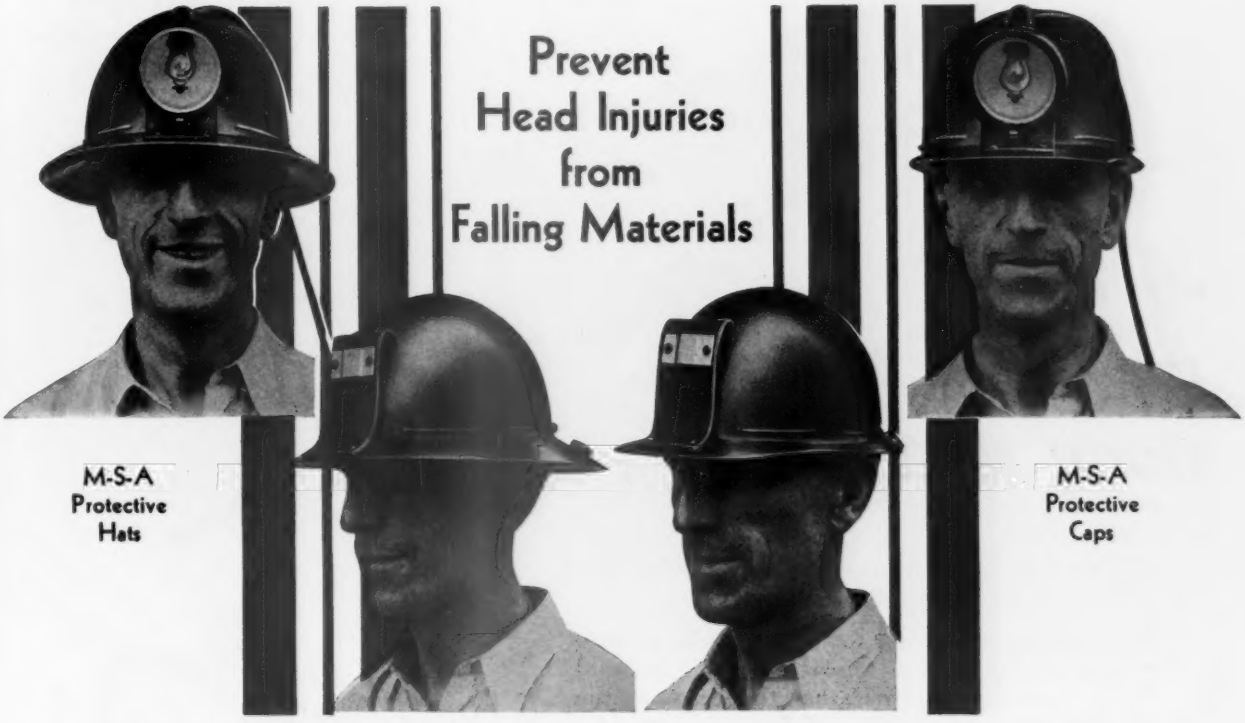
If your organization is equipped to do oxwelding you are equipped with the most effective means of providing against preventable waste. If not, it will mean money to you to investigate the possibilities of oxwelding for plant maintenance and repair.

THE LINDE AIR PRODUCTS COMPANY, THE PREST-O-LITE COMPANY, INC.,
OXWELD ACETYLENE COMPANY, UNION CARBIDE SALES COMPANY,

Units of UNION CARBIDE AND CARBON CORPORATION

General Offices . . . . . New York UCC **Sales Offices . . . in the Principal Cities**
65 Linde plants . . . 48 Prest-O-Lite plants . . . 174 Oxygen Warehouse stocks . . . 156 Acetylene Warehouse stocks . . . 42 Apparatus Warehouse stocks . . . 245 Union Carbide Warehouse stocks

M-S-A PROTECTIVE HATS AND CAPS



BETTER HEAD PROTECTION!

M-S-A Protective Hats and Caps are being used by Coal and Metal Mines with unusually successful results in reducing Head Injuries among the vast army of workmen employed underground or otherwise exposed to the hazards of falling materials.

CORRECTLY DESIGNED AND BUILT

M-S-A Protective Hats and Caps are made of Insulated Materials without exposed metal parts, embodying the following Essential Features:

DURABLE—These Hats and Caps are moulded Safety Helmets—moulded in one piece without seams and absolutely waterproof and acid resisting. The shell is unusually durable—the lining is replaceable at a small cost.

LIGHT WEIGHT AND STRONG—These Hats and Caps are light in weight, well balanced and sufficiently strong to withstand any blow the neck will stand.

WELL VENTILATED—A tough leatherette lining cushioned with felt pad spacers, to provide proper ventilation and balance, insures a comfortable fit.

"Everything for Mine and Industrial Safety"

MANUFACTURED IN STANDARD HAT SIZES

M-S-A Protective Hats and Caps are made in fifteen standard hat sizes, ranging from 6 to 7¾ with or without lamp holders as desired. These Hats and Caps can also be worn by Mine Rescue Crews, equipped with gas masks or oxygen breathing apparatus.

Proper Head Protection Is Essential!

ASK TO HAVE OUR REPRESENTATIVE SHOW YOU THESE HATS AND CAPS

Mine Safety Appliances Co.

Braddock, Thomas and Meade Sts., Pittsburgh, Pa.

MINE SAFETY APPLIANCES CO.
Braddock, Thomas and Meade Sts.
PITTSBURGH, PA.

Without obligation, please have your representative show us the M-S-A Protective Hats and Caps:

COMPANY.....

ADDRESS.....

.....

SIGNED.....

-because we build them BETTER

SERVICE costs money—no matter who pays for it.

The simplest, surest way to reduce service costs to us and loss of time to Cosco owners, is to build Cosco Conveyors so well that they require the absolute minimum of "time off."

Every detail of construction—not only basic design, but every gear, every bolt, every rivet must withstand the severest usage to which they'll ever be put.

More than four hundred successful installations in American mines speak volumes for Cosco Conveyor design—and the lowest record of "off duty" tells an eloquent story of durable service.

Let us show you positive proof of what Cosco Shaker Conveyor Drives, with the Duckbill, can accomplish in your mines—in increased production at lower cost and surer profits.

CONVEYOR SALES CO., INC.
299 Broadway, New York

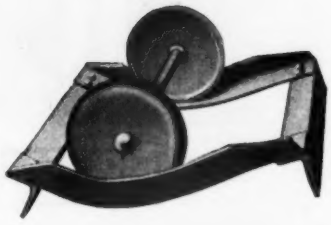
District Sales Offices

Pittsburgh, Pa., 1538 Montier Street, Wilkinsburg.
Scranton, Pa., Mears Building.
Huntington, W. Va., 817 Tenth Avenue.
Knoxville, Tenn., 2725 Magnolia Avenue.
Salt Lake City, Utah, Salt Lake Hardware Co.
Denver, Colo., Stearns Roger Mfg. Co.
Birmingham, Ala., 1802 American Trust Building.
Chicago, Ill., 224 South Michigan Avenue.
Pittsburg, Kansas.

Cosco Shaker CONVEYOR

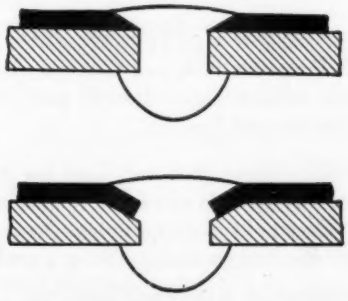
Elasticity with Great Strength

Cosco Troughs are made of special analyses open hearth Manganese steel plate proved by sixteen years' experience most resistant to abrasion and corrosion. Joints are accurately fitted and easily connected.



Improved Flanged Steel Rollers

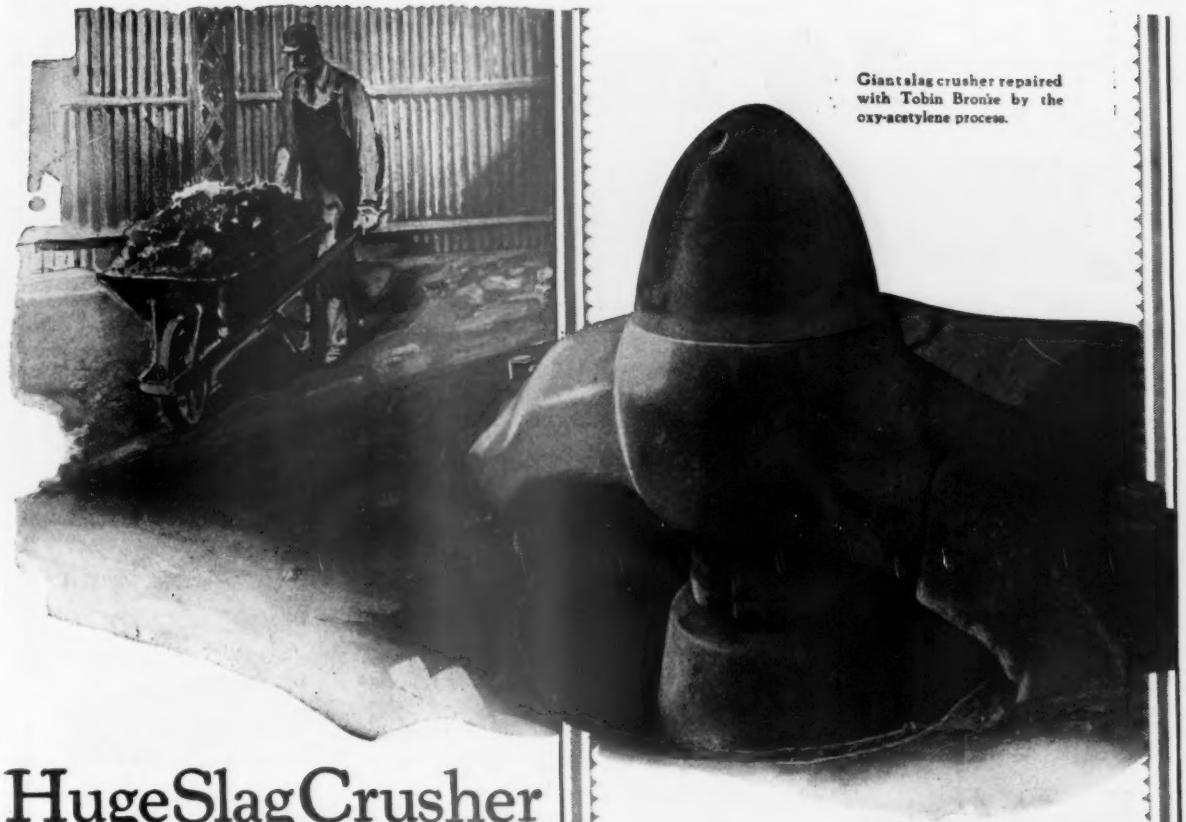
Flanged and fixed to axles in one operation. Curved on inner edge to fit cradles perfectly. Infinitely stronger than rollers made from any cast materials.



Rivets That Stay Put

Upper illustration shows the usual way of riveting troughs. Note in lower illustration how Cosco Troughs are rivetted. Practically four times as much trough metal is held by the rivet head, making unions that will not easily loosen or tear out.

"Convey Your Coal The Cosco Way"



Giant slag crusher repaired with Tobin Bronze by the oxy-acetylene process.

Huge Slag Crusher repair-welded in 16½ hours, with TOBIN BRONZE

ANACONDA
from mine to consumer

There is a suitable Anaconda Filler Rod for every bronze-welding purpose. Principal Anaconda Welding Rods, with their melting points, are listed below:

for oxy-acetylene welding

Tobin Bronze*	1625°F
Manganese Bronze	1598°F
Brazing Metal	1634°F
Naval Bronze	1625°F
Electrolytic Copper	1981°F
Silicon Copper	1981°F
Phosphor Bronze	1922°F
Everdur*	1866°F

for arc welding

Silicon Copper	1981°F
Phosphor Bronze	1922°F
Everdur*	1866°F

*Reg. U. S. Pat. Off.

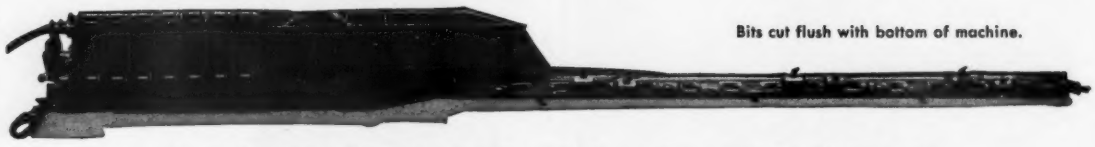
WHEN the cast-iron arm of this slag crusher was fractured, a serious delay seemed certain. But Tobin Bronze Welding restored the machine to service after a loss of only a few days' time. One day was spent in pre-heating —another in chipping. Actual welding time was 16½ hours. 325 lbs. of Tobin Bronze and 2900 feet of gas were used.

The high strength and uniform composition of Anaconda Copper Alloy Welding Rods are due to the experience and technical knowledge of The American Brass Company in developing alloys suitable for every bronze-welding purpose. Publication B-13, containing detailed information, mailed on request.

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Canadian Mill: Anaconda American Brass Ltd.
New Toronto, Ontario

ANACONDA
WELDING RODS

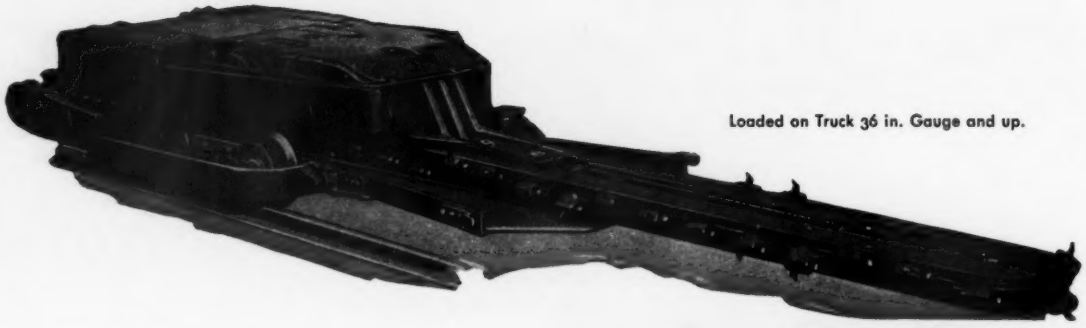
16 in. Low



Bits cut flush with bottom of machine.

50 hp. Goodman Universal Control Low Vein Shortwall—Open or Government Permissible Construction.

21 in. Low



Loaded on Truck 36 in. Gauge and up.

For Miners of THIN SEAMS

Embodied in the new 16 in. overall height Goodman Universal Control Low Vein Shortwall are the features that made other types of Goodman Shortwalls so popular in all coal fields. In addition, several improvements and new features have been built into this new Low Vein Shortwall:

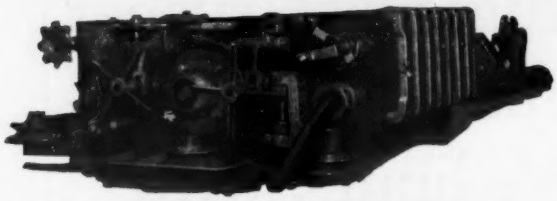
Simple rugged construction.

More accessible than standard height machines.

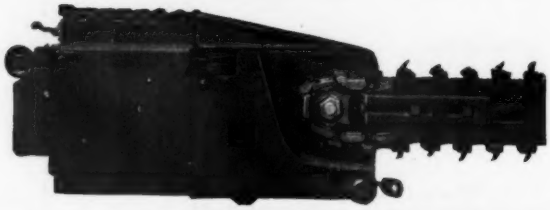
Convenient location of operating controls to assure efficient and SAFE operation.

Both head and tail rope drums are power driven and equipped with brakes.

EACH drum has TWO variable speeds, high and low, permitting runner to maneuver machine easily and SAFELY at will—just like the standard height Goodman Universal Control Machines.



All controls grouped at rear of machine WHERE THEY BELONG for convenient, efficient and SAFE operation—just like the higher Goodman machines.



Bottom view—flush bottom cutting—no pan nor any part of machine extends below chain bits. Large arc-shaped side outlet for free disposal of cuttings.

The machine cuts flush with its own base—a smooth floor, without scrapping. The "down" bits in the chain cut flush with the bottom of the machine, thus enabling the runner to cut on the bottom, to full depth of the undercut. No scrapping is required—an important saving.

MORE ABOUT IT IN BOOK M-301—SENT UPON REQUEST.

GOODMAN MANUFACTURING COMPANY

HALSTED ST. at 48TH.
CHICAGO - - - ILL.

Locomotives - Loaders - Coal Cutters

PITTSBURGH-WILKES-BARRE-HUNTINGTON, W.VA.-CINCINNATI-BIRMINGHAM-ST. LOUIS-DENVER-PRICE, UTAH

(39)

KEEPING DOLLARS FROM WAITING ON DIMES

NURSE-MAIDS *to a Motor Starter*

WHENEVER men spend their time starting a motor, they are doing work that a piece of machinery should be doing. These men could do more productive labor, but their hands are tied to the handles of non-automatic motor starters—"a dollar waiting on a dime."

Why not release these men, and let them take their rightful place—their place in the constructive effort to lower production costs? Free them to do more vital work. This simple task of restarting motors can be handled more effectively and more cheaply with an O-B Automatic D. C. Motor Starter. The number of mines which are doing this grows larger every day. And they are finding freedom from the maintenance which attends the ordinary starter, because the O-B Starter is made especially for the hard service of mines. The New O-B Automatic D. C. Motor Starter has unique and practical advantages which every man should know if he is properly concerned with saving money. Are you familiar with these features? If you will send for a copy of Booklet No. 568M it will give you complete information.

O-B AUTOMATIC D. C. MOTOR STARTER

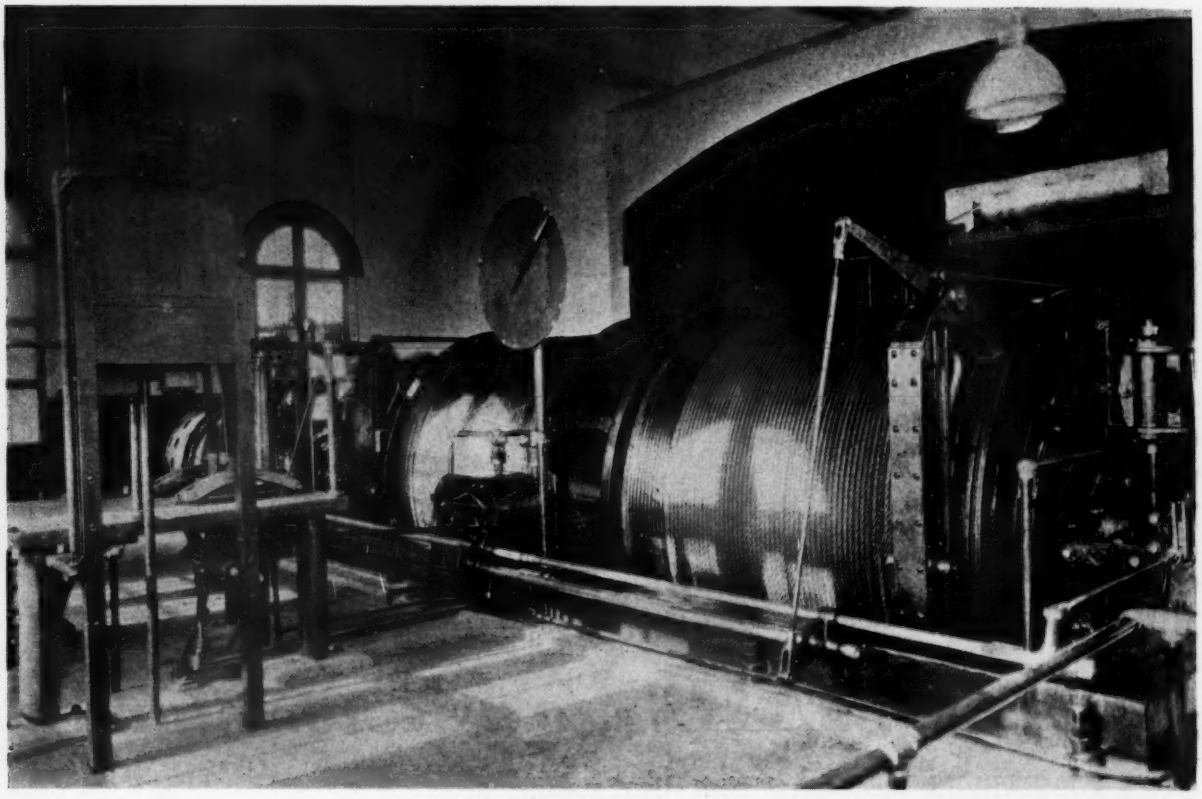
A circuit breaker incorporated as a part of this starter affords full protection to the motor. The starter is simple, compact, and rugged. Described on pages 20-21, O-B New Products Supplement No. 3.

Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co., Limited
Niagara Falls, Canada
12208M

Ohio Brass Co.

NEW YORK PITTSBURGH CHICAGO CLEVELAND ST. LOUIS ATLANTA DALLAS
PHILADELPHIA BOSTON OS ANGELES SAN FRANCISCO SEATTLE

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES



The 600 H.P. Hoist above is installed at the Loomis Colliery of the Glen Alden Coal Company at Nanticoke, Pa. Its characteristics are as follows: tight and loose drums, 10′ 0″ diameter, 8′ 10″ face; drum shaft bearings 15″ x 26″; center bearing 16″ x 26″; drum shaft—16″ diameter; depth of shaft—1,600 feet; weight of cage—13,000 lbs.; weight of car—3,000 lbs.; weight of coal—8,000 lbs.; diameter of rope—1½″; rope speed—2,200 ft. per minute.

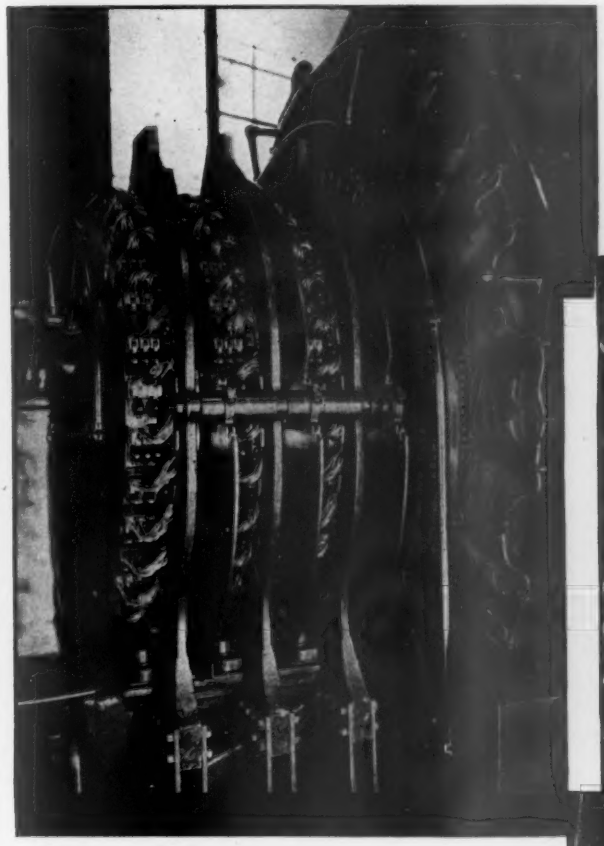
ADVANCED engineering practice, high-grade materials and careful workmanship have built the reputation of the Vulcan Iron Works. These qualities are responsible for the world-wide use of Vulcan mining equipment. Whether it is a steam locomotive or a shaking conveyor; a great kiln or a small casting; a mine fan or a scraper loader the same care, the same thoroughness of design goes into every machine turned out. In every mining field will be found old Vulcan equipment that has been serving faithfully for many years or new Vulcan equipment that has kept full pace with the advances in mining practice.

We will be glad to correspond with you about any equipment problem in coal or metal mining. Bulletins upon request. Remember that Vulcan covers practically the full gamut of mining and has back of it the practical experience and resources of a great manufacturing organization established for over 80 years.

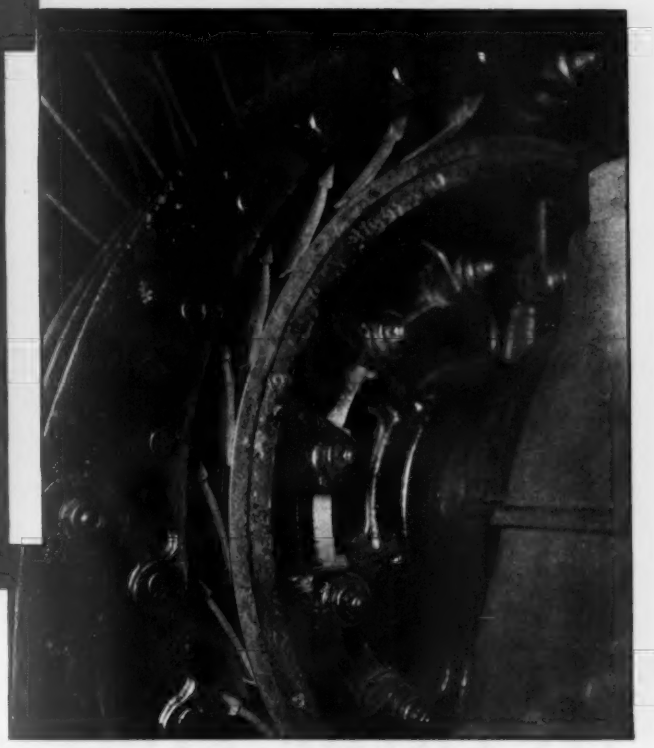
VULCAN IRON WORKS, Wilkes-Barre, Penna.

VULCAN of WILKES-BARRE HOISTS

what price economy?



Slip-rings of modern 13,000-ampere, booster-type rotary converter, equipped with National Pyramid metal-graphite brushes



Slip-rings of rotary converter equipped with old-style copper-leaf brushes

The heavy loads of fall and winter are but a few weeks away. This is the time to check-up brush equipment and make sure that it is in condition to carry through the winter without interruption of service. This precaution is especially important in regard to slip-rings of large rotary converters where metal-graphite-composition brushes have superseded the old copper-leaf. Brush-springs should be set up to correct tension and accurately equalized on all the holders. Shunt connections should be clean and firmly secured. Worn brushes should be replaced.

"JUST one of the inevitable snags of the business." That was the attitude toward the heavy expenses involved in turning, grinding, and replacing slip-rings and commutators in the days of copper-leaf, metal-gauze and early abrasive carbon brushes. Ridging and wear caused by these brushes demanded resurfacing at frequent intervals. Maintenance costs were *high*.

In stepped National Carbon Company, Inc., offering its vast research-facilities for the purpose of developing better and more economical brushes. Experiments, trials, more experiments — *success*. Soon National Pyramid Brushes had established new standards, higher speeds had been met, heavier loads and more compact design had become possible. The new brushes kept machinery humming for months and months *without* interruptions.

Major faults corrected, minor faults assumed new importance. Systematic inspection and timely adjustments are a small price to pay for the economical performance of modern brushes. National Pyramid Brushes insure satisfactory service and low maintenance cost in return for this care.

NATIONAL CARBON COMPANY, INC.

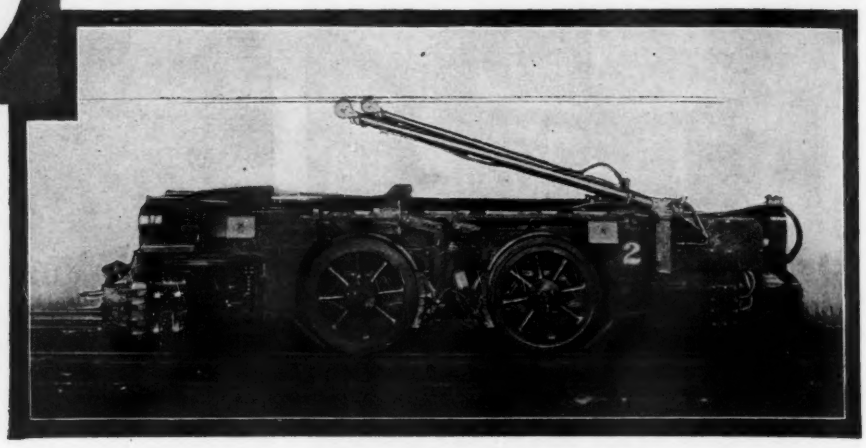
Unit of Union Carbide UCC *and Carbon Corporation*

Carbon Sales Division | SILVER STRAND CABLE | Cleveland, Ohio

Branch Offices and Factories:
New York Pittsburgh Chicago Birmingham San Francisco

15

Baldwin-Westinghouse 8-ton Explosion-tested Locomotive for The Crab Orchard Improvement Co.



Fifteen aids to safer coal mining

WHEN The Crab Orchard Improvement Company of West Virginia sought gathering locomotives whose operation would not jeopardize the safety of their men and property, they selected the improved Baldwin-Westinghouse explosion-tested locomotive illustrated above. Their order for fifteen of these locomotives followed.

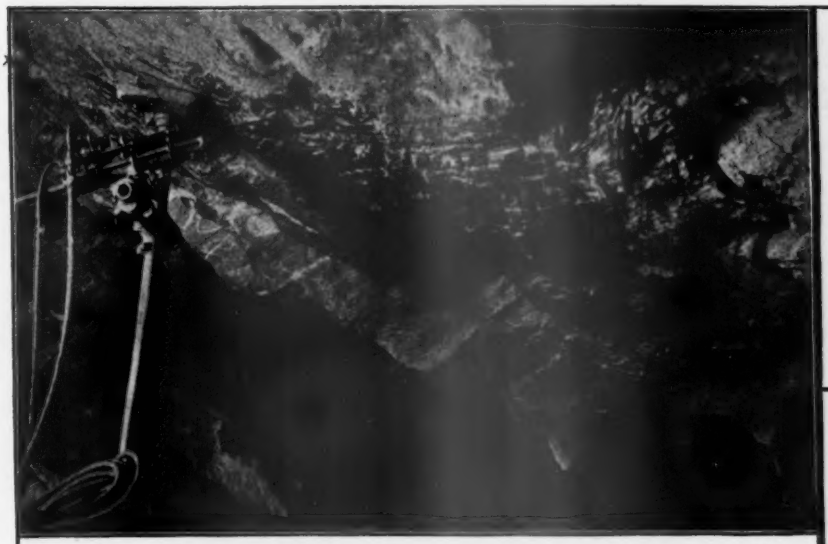
Baldwin-Westinghouse mine locomotives for gathering and haulage purposes are manufactured in various types and sizes.

The Baldwin Loco. Works, Philadelphia, Pa.—Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

Baldwin-Westinghouse

T 31459

TUNE IN THE WESTINGHOUSE SALUTE OVER THE N. B. C. NATION-WIDE NETWORK EVERY TUESDAY EVENING.



WHEN MINING CONDITIONS ARE COMPLICATED

Complex faults and folds in metamorphic rock areas may delight geologists—but not mine superintendents. The job of mining under such conditions is no easy one, although the selection of proper methods, equipment, and supplies considerably offsets natural difficulties.

Specifying the correct explosive for each blasting need is one way of making mining easier. Because the Hercules Powder Company has explosives for all purposes, mine superintendents know that each blasting requirement will be met by one of them.

The list at the right briefly describes this complete series. Of course, there is more to be said about each type of explosive than is included in this coupon-list, so check and mail it for the information concerning the explosives in which you are interested.

HERCULES POWDER COMPANY
INCORPORATED

ALLENTOWN, PA. BIRMINGHAM BUFFALO CHICAGO DENVER DULUTH
Wilmington Delaware
HAZLETON, PA. HUNTINGTON, W. VA. JOPLIN, MO. LOS ANGELES
NEW YORK CITY NORRISTOWN, PA. PITTSBURG, KAN. PITTSBURGH, PA.
POTTSVILLE, PA. ST. LOUIS SALT LAKE CITY SAN FRANCISCO WILKES-BARRE WILMINGTON, DEL.

THE EXPLOSIVE FOR YOUR WORK IS IN THIS LIST

☐ **HERCULES GELATIN EXTRA L. F.**—Dense and strong · plastic and water-resisting · first in fumes · the leading gelatin-type, all-purpose explosive · strengths: 30% to 90% · 190 cartridges.*

☐ **HERCULES GELATIN L. F.**—Dense and strong · plastic and water-resisting · needed only under severest conditions · first in fumes · strengths: 20% to 90% · 184 cartridges.*

☐ **GELAMITE 2**—Semi-plastic · water-resisting · bulkier than the gelatins · often replaces gelatins up to, and including, 40% strength at a saving in cost · 240 cartridges.*

☐ **HERCULES STRAIGHT NITROGLYCERIN L.F.**—Strong · fast · water-resisting in higher strengths · strengths: 15% to 60% · 208 cartridges.*

☐ **HERCULES EXTRA L. F.**—For general blasting · strengths: 20% to 60% · 220 cartridges.*

☐ **HERCOMITES 2 to 7**—General purpose explosives · very economical where suitable · 240 cartridges* for No. 2, to 350 for No. 7 · also Hercomite Bag packed in 12½ lb. bags.

☐ **HERCULES TORPEDO GELATIN**—Replaces liquid nitroglycerin for shooting oil, gas, and water wells · strength: 80% · 196 cartridges.*

☐ **HERCULES BLASTING GELATIN**—Water-resisting and powerful · valuable for submarine blasting, shooting gas or oil wells · 100% strength · 200 cartridges.*

☐ **HERCULES CONTRACTORS DYNAMITE**—Low-strength explosives with strong heaving action · strengths: 5%, 10%, 15%, 20% · 5% packed in 12½ lb. bags only, others 216* cartridges.

☐ **HERCULES BLASTING POWDERS**—"A": 8 granulations (coarse to fine) and dust—"B": 7 granulations and Herco—Herco: used in well-drill holes with Cordeau-Bickford detonating fuse—all powders packed in 25 lb. kegs.

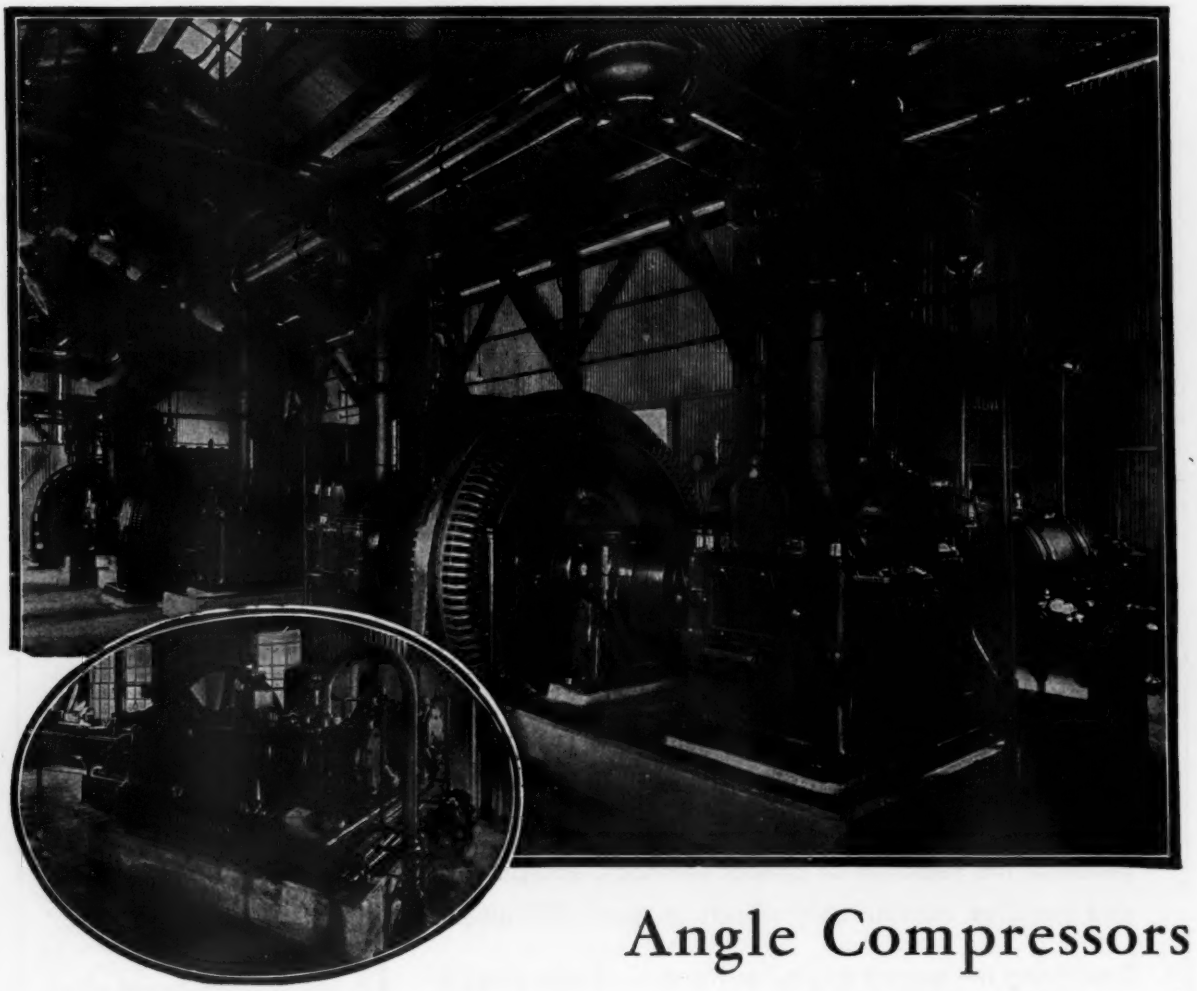
☐ **HERCULES BLASTING SUPPLIES**—A complete series of detonators and blasting accessories.

***NOTE: Cartridge counts refer to the approximate number of 1¼" by 8" cartridges in 100 lbs. of the explosive.**

• • •

HERCULES POWDER COMPANY
(Incorporated)
934 King Street, Wilmington, Delaware
Gentlemen: Please send me pamphlets describing the explosives checked.

Name .....
Company .....
Street .....
P. O. C-2



Twin Angle Compressors like these at New Cornelia are widely used by many Southwestern mines.

Oval: This "WJ" 12—7½x10 Sullivan Compressor has been in service at Ajo for 14 years, and is still "going strong."

Angle Compressors

at New Cornelia

Supply Air Power Cheaply

THREE Sullivan "WN-4" Twin Angle Compressors furnish air for mining operations at the New Cornelia Unit of the Calumet & Arizona Mining Co. at Ajo, Arizona. These compressors are direct-driven by synchronous motors, and furnish a maximum capacity of more than 7500 cubic feet of free air per minute. Twin Angle design, multi-unit installation and synchronous motor drive, combine to provide an air power supply unsurpassed in low cost and flexibility.

New Cornelia has been buying Angle Compressors since 1917. A single, belted unit is in use for water supply.

In the machine shops at Ajo, air is furnished by the old-style, cross-compound belted Sullivan Compressor shown in the oval. This unit was installed in 1916, and is still giving daily service. A good machine, it was rendered obsolete as a type, when Sullivan engineers designed Angle Compound Compressors.

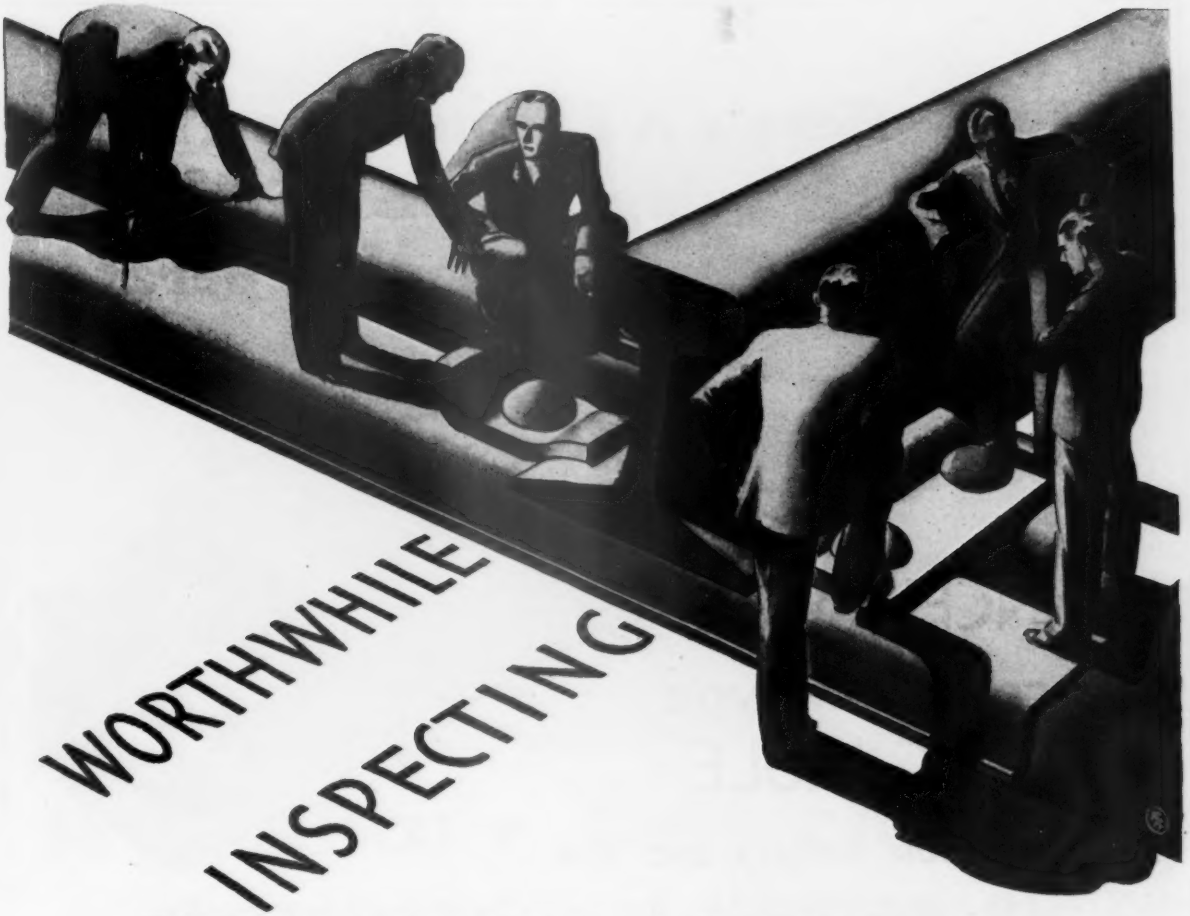
BALANCED SULLIVAN ANGLE COMPOUND

Boston New York Cleveland Birmingham Pittsburgh St. Louis Knoxville Dallas Duluth Denver Salt Lake City Spokane

SULLIVAN MACHINERY CO.
808 Wrigley Bldg., Chicago

El Paso San Francisco Butte London Paris Katowice Algiers Johannesburg Mexico Santiago Calcutta Sydney Tokyo

SULLIVAN Trade Mark



THOSE interested in efficient and economical track construction will find Carnegie Copper Steel Mine Ties worthy of their attention. Pictured above is one of the many popular Carnegie sections available. Note its sturdy construction—the broad foot, the wide bearing surface and center groove, which tend to prevent the tie from sinking into soft bottom. This section is light and strong, and its shallow depth recommends its use in low seams of coal. The outside fastening is securely riveted to the tie. Double inside clips clinch the rail, insuring true-to-gauge construction. No special tools or fittings are necessary in laying the tie. A hammer blow locks the clips.

Carnegie Copper Steel Mine Ties are efficient tools of modern mining. They are rust-resistant, thus assuring a much longer life than ordinary steel ties can give. Literature, descriptive of the entire line, will be sent at your request.

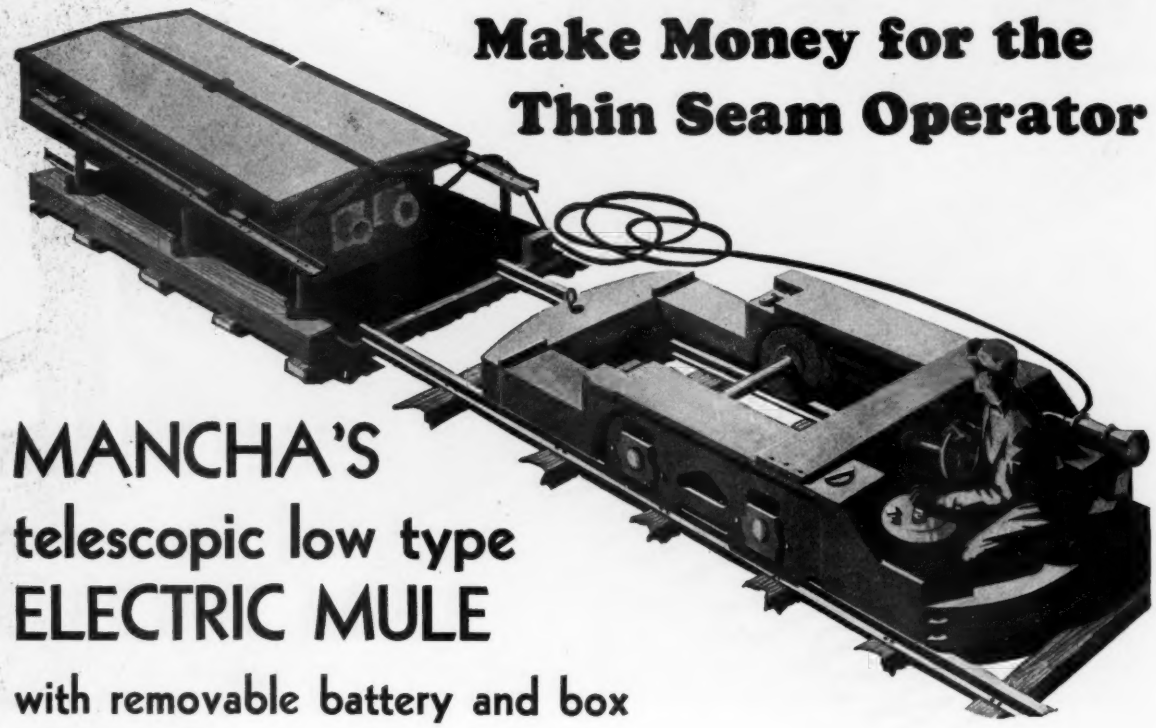
CARNEGIE STEEL COMPANY - PITTSBURGH, PA.

Subsidiary of United States Steel Corporation

87

CARNEGIE
COPPER STEEL MINE TIES

Here's A Locomotive That'll Make Money for the Thin Seam Operator



MANCHA'S telescopic low type ELECTRIC MULE

with removable battery and box

No longer is it necessary for the thin seam operator to have a chassis for every battery. With the new Telescopic Mancha Electric Mule the exhausted battery can be replaced with a fully recharged one at any time. Work it twenty-four hours a day, with a short stop at the end of the shift to drop the battery and pick up a fully recharged one. (Mancha's Transfer Rack makes this easy, too.) Send for Bulletin that gives complete information.

Mancha Storage Battery Locomotive Co.

1909 South Kingshighway
St. Louis, Mo., U.S.A.

Five - 3 compartment Woodbury Jigs for Georgia Manganese and Iron Co. with individual motor and Texrope Drive.

Woodbury Jigs combine classifying and jigging operations and eliminate much preliminary separation

The economy of the Woodbury System of Concentration consists primarily in the simplification of the processes intervening between the crushing section of a mill and the smelter. Summarized, its advantages are as follows:

Capacity **— Units of large capacity, thus retiring a large area of jig sieves.**

Mixed Feeds **— By uniting the classifying and jigging operations into one, fewer sizing screens and elevators are used, and hydraulic classifiers eliminated.**

Slime Separation **— A dense original slime, treated direct on tables, retires a large settling tank area.**

Concentrates **— Recoveries and grade of concentrates are increased.**

Middlings **— An improved middling classification, reducing quantity to be recrushed.**

Tailings **— Lower tailing losses obtained in all cases.**

Water **— Milling water less by one-half.**

Power **— Costs reduced materially.**

Labor **— Costs per ton of ore reduced.**

Floor Area **— Always less, and in some cases cut in two.**

Construction **— All iron and mechanically correct.**

ALLIS-CHALMERS

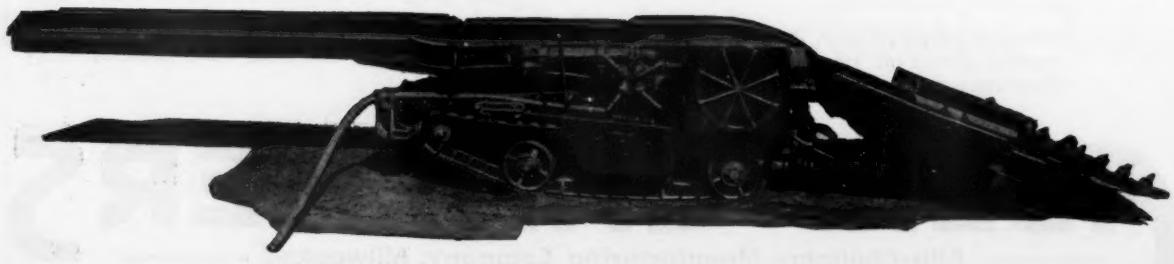
Allis-Chalmers Manufacturing Company, Milwaukee

TAKING JOY Tonnages from LOW COAL NOW

Joy Loading Machines are consistently breaking records every year. Now the operating limits of this practical machine have been greatly extended. The new 7-BU brings the advantages of Joy Loading to low coal. Forty inches high, with a flexible continuous conveyor, it is guaranteed to load two tons a minute. One man controls operations of this new loader, which is in all respects like the larger 5-BU unit except for the conveyor. Write now for descriptions and additional operating data.

The 7-BU JOY LOADER

JOY MANUFACTURING COMPANY
FRANKLIN, PENNSYLVANIA



Announcing the UCC METHANE INDICATING DETECTOR

THE Coal Mining Industry has long needed a quick, accurate and dependable means of detecting and measuring methane gas.

The Union Carbide Company—U. C. C.—Methane Indicating Detector has been designed to fill this need. It is light—easily carried into the atmosphere to be tested.

Operation of the Detector is simple. The percentage of methane present is immediately indicated on the scale.

The U. C. C. Methane Indicating Detector has been approved by the U. S. Bureau of Mines as permissible equipment. Dependable, portable, self-contained, it meets every safety requirement.

Return the coupon for a descriptive booklet. If you wish a demonstration, write or telephone the nearest District Office of the Union Carbide Sales Company or of E. D. Bullard Co.

Distributed by

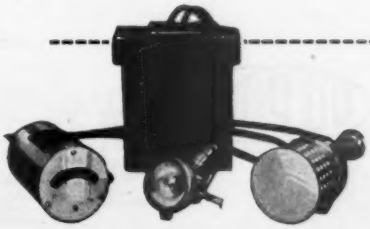
UNION CARBIDE SALES COMPANY

Unit of Union Carbide UCC *and Carbon Corporation*

NEW YORK CHICAGO SAN FRANCISCO

and

E. D. BULLARD CO. SAN FRANCISCO CHICAGO



M.C.J.—9-30.

Union Carbide Sales Company, Safety Appliance Department, 30 East 42nd Street, New York

Please send me your booklet describing the U. C. C. Methane Indicating Detector.

Name..... *Position*.....

Company..... *City*.....

Street Address..... *State*.....

Some famous du

and the uses to which they are adapted

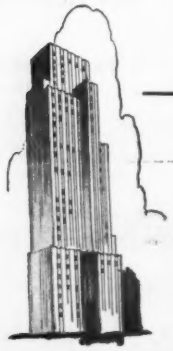
(A handy chart well

USES	"B" BLASTING POWDER	DUROX	DU PONT EXTRA	RED CROSS EXTRA
Clay Mining (Open)	1st Deep Sprung Holes	1st	2nd D-H	1st
Clay Mining (Underground)	3rd	1st	2nd D-H	2nd 20%-40%
Excavating for Foundations	2nd Deep Sprung Holes Clay and Shale	2nd	3rd	1st 20%-40%
Gypsum Mining	0	2nd	3rd	2nd
Open Pit Mining	1st Deep Sprung Holes Soft Material	2nd	?	1st 20%-60%
Ore Mining (Underground)	0	3rd	2nd	2nd
Quarrying	2nd Tunnel Blasts	2nd Soft Limestone	1st Shale and Soft Limestone	1st Shale and Soft Limestone Also Tunnel Blasts
Roads and Railroads	1st Deep Sprung Holes Soft Material	?	?	1st 20%-60%
Salt Mining	0	1st	1st	3rd
Tunnels and Drifts	0	0	?	3rd

1st, 2nd, 3rd, 4th—Order of preference. 0—Should never be used.

The chart shown above is designed to help you select explosives which will give the best results in proportion to costs. Eight well-known du Pont explosives . . . and the chief kinds of blasting to which they are adapted . . . are given in the table. There are other du Pont explosives that can be used for some of the blasting work mentioned, but these eight give an excellent coverage for the particular fields.

When you specify du Pont explosives for the jobs you undertake, you specify explosives into whose making has gone more than a century and a quarter of experience. With du Pont explosives you are assured of satisfactory execution. For each du Pont explosive has been made, after thorough chemical research and study, to do the most efficient work in the blasting operation for which it is intended.



E. I. DU PONT DE NEMOURS & CO., Inc. ***Explosives***

DU PONT REG. U. S. PAT. OFF.

DU PONT REG. U. S. PAT. OFF.

Pont explosives

other than coal mining and agriculture

worth your saving)

DU PONT GELATIN	DU PONT SPECIAL GELATIN	DU PONT QUARRY GELATIN	STRAIGHT DYNAMITE
?	?	?	?
?	?	0	?
2nd Rock Only	2nd Rock Only	2nd Rock Only	3rd Rock
1st–20%	1st–35%	0	1st–20% L. D.
?	3rd Wet Holes	3rd Wet Holes	3rd
1st	1st	0	4th
2nd Granite and Hard Limestone	2nd Granite and Hard Limestone	1st Granite and Hard Limestone	2nd Granite and Hard Limestone
2nd Very Hard Rock Only	2nd Very Hard Rock Only	1st Very Hard Rock Only	3rd
4th	?	?	?
1st	1st	0	?

?—Can be used but is not recommended.

DU PONT
REG. U.S. PAT. OFF.

Department **WILMINGTON, DEL.**

Quick facts about these eight du Pont explosives

♦

"B" BLASTING POWDER. A deflagrating explosive made in seven standard granulations, of uniform size grains, and the railroad granulation which is a mixture of several sizes of grains. In material to which blasting powder is adapted it is probably the most economical explosive to use. Can be used only in dry work as it is readily affected by water.

♦

DUROX. An ammonia dynamite of low density and high velocity. Fumes are good. Its high cartridge count . . . 160 sticks to the case . . . makes it economical to use. Suited for blasting salt, limestone and gypsum.

♦

DU PONT EXTRA DYNAMITE. Low-density ammonia dynamite. Made in five types, all of them the same weight strength but varying in density and bulk strength. Strengths from 20% to 55%. Fumes are less objectionable than Red Cross Extra.

♦

RED CROSS EXTRA DYNAMITE. Probably the most popular high explosive on the market. Made in strengths from 15% to 60%. 102 to 106 sticks to the case.

♦

DU PONT GELATIN. Especially adapted for close work where ventilation is poor. Gives minimum of obnoxious fumes. Highly water resistant. Is plastic and loads solidly in bore holes.

♦

DU PONT SPECIAL GELATIN is similar in most respects to du Pont Gelatin except that it is not quite so water resisting and not adapted for very wet work. Its fumes have a different flavor from du Pont Gelatin, but are no more obnoxious.

♦

DU PONT QUARRY GELATIN. A type of gelatin dynamite developed especially for open work where the nature of the fumes is not important. It has same density, plasticity and water-resisting qualities as regular gelatins . . . and is stronger, grade for grade. Cannot be used in close work. Excellent for all kinds of outside work.

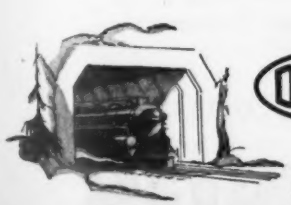
♦

DU PONT STRAIGHT DYNAMITE. The type of high explosive from which all others are graded. Is the quickest acting and most sensitive of them all, is highly water resistant and is the best explosive for mudcapping and propagated shots. It is not adapted for use in sprung holes owing to its sensitiveness, nor in close work, as its fumes, especially in the higher grades, are likely to be too obnoxious.

All above explosives are low freezing

♦

BLASTING ACCESSORIES. To fire the different explosives in the great variety of ways in which they are loaded requires efficient blasting accessories. The du Pont Company makes a complete line of these. Specify du Pont blasting accessories when you order explosives.



DU PONT
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DU PONT
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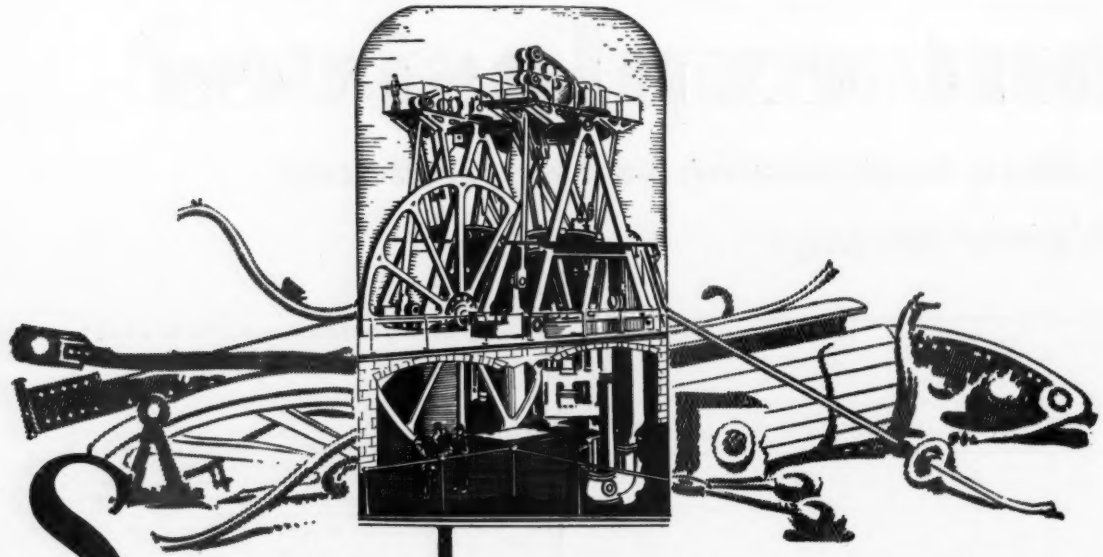

Scrap those Obsolescent Machines

How many obsolescent machines are there in your plant... machines that are rapidly growing out of date... machines that can not keep up with today's demands in speed, production, precision, low operating charges ... machines that are eating up your profits ... machines that are sapping the very life blood of industry?

If you could reduce your power costs 20% with modernized machinery, wouldn't it pay you to scrap the obsolescent friction-ridden power wasters? Timken Bearings are doing just that in many types of equipment.

If you could save 80 to 90% of your lubrication costs, wouldn't it be worth your while to do away with machines that need so much more lubricant? In most types of machinery, Timken Bearings regularly effect such lubricating economies.

If you could increase the productive time of your machinery by eliminating involuntary shut-downs for bearing replacements, wouldn't it pay you to discard undependable equipment? Timken Bearings make all types of machines more dependable in even the hardest kinds of service.

If you could produce more accurate work in less time with fewer rejects, wouldn't you have a strong incentive to bring your equipment in line with modern developments? It is being done by Timken Bearings in all types of precision machinery.

If you could cut your maintenance costs 80 to 90%, wouldn't it be good business to throw out machinery that costs so much more for upkeep? Timken Bearings are minimizing maintenance in machines of all kinds.

When you consider that all of these potential benefits are available to you in modern "Timken Bearing Equipped" machinery, there isn't much room left for argument. With this thought in mind, it will pay you to check up on all of your mechanical equipment, remembering that there is *only* one combination that meets every modern anti-friction requirement—the exclusive combination of Timken tapered construction, Timken positively aligned rolls and Timken-made steel.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

The
MINING CONGRESS JOURNAL

**A Monthly Magazine—The Spokesman For The Mining Industry—
Published By The American Mining Congress**

VOLUME 16 SEPTEMBER, 1930 No. 9

Editorials

State Responsibilities

A MOST forceful note of warning was presented by the Chief Justice of the United States, Charles Evans Hughes, before the American Bar Association, at its recent convention in Chicago, concerning the responsibility and importance of self-governed states as a bulwark to our Republican form of government. We quote Justice Hughes:

"Paradoxical as it may seem, not only the security, but the efficiency of the Union lies in the appropriate maintenance of the authority of the states within the proper spheres of local government and local policy. Despite all the economic changes and the intimacies of closely related activities, notwithstanding the vast expansion of interstate commerce in novel forms leading to unanticipated applications of the national authority, which was granted with extraordinary wisdom in a very general formula, the states continue as reservoirs of power reserved, not conferred, by which they deal with a multitude of particular concerns, and enjoy differentiations congenial to local sentiment.

"However difficult it may be, in constitutional interpretation, to maintain perfectly, and to the satisfaction of all, this balance between state and nation, it is of the essence of American institutions that it should be preserved so far as human wisdom makes this possible, and that encroachments upon state authority, however, contrived, should be resisted with the same intelligent determination as that which demands that the national authority should be fully exercised to meet national needs."

During the last quarter of a century continuous inroads have been made by Federal agencies into the functions of state government as provided by the Federal Constitution. Those who recognize these encroachments, without reference to the inducing causes, are likely to blame the Federal Government and to criticize what they refer to as bureaucacy. The fact is that practically every encroachment of the kind complained about has been induced by the people within the several states who have asked for Federal aid which could not be given without Federal interference in state affairs. The people themselves then are more largely responsible for these conditions than they are willing to admit. Justice Hughes has again called attention to the dangers involved in every surrender of those powers not conferred upon the Federal Government at the time of adoption of the original constitution which made us a Government.

Well may we ponder upon the results of many of the constitutional amendments already adopted, and the probable results of those which are being constantly proposed, and advocated. In our discussion of the advisability of the repeal of thousands of laws which have already been enacted by Congress and the various state legislatures, we may be equally certain that a repeal of some of the amendments to our Federal Constitution (indeed every amendment to that constitution, which increases the power of the Federal Government in the control of state affairs), would be advisable. The difficulties of government and the risks which this Government of ours still carries as the first great and successful experiment of self-government will be augmented by every step which destroys the symmetry of that greatest of all human governmental documents the Constitution of the United States.

The Gold Outlook

THE most progressive nations of the world are those which have a gold reserve of sufficient size to assure stable money. Excepting Belgium, France suffered more by the World War than any other nation. Her buildings and manufacturing plants were destroyed, her farms ruined, her wealth wasted, and her man-power tremendously depleted. Today France is one of the most prosperous countries of the world. From a point of considerable less gold than some of her neighbors, she now possesses half as much gold as the United States, and nearly double that of Great Britain. Her economic policies are such as to insure industrial activity to absorb the greater part of her industrial power. This means increased earnings and increased wealth accumulation.

A Paris dispatch states that France with the second largest store of gold in the world may soon turn to the collection of a huge stock of silver to permit re-introduction of silver coinage. Notwithstanding the superior position which France occupies because of her large gold stock, her statesmen insist that that stock must be increased and that the purchase of silver will put France on a sound money basis as good as the best countries in the world and better than any of her direct competitors. No country can prosper permanently except in proportion to the stable money available for the transaction of its business. France will soon occupy a premier position among the nations of the world.

Silver at the Bottom

IT IS confidently believed by careful students of the silver situation that the price of silver will be steadily increased as buyers throughout the world are impressed with the belief that the lowest point has been reached. France is reported to be purchasing silver. The Indian government has disposed of practically all of the silver which it planned to sell and the horded silver in the hands of the people of India is not likely to be put upon the market. The hope that the Chinese situation promises to become more stable leads to the belief that China will again be a purchaser of silver. The present low price has put a handicap upon production which will soon be apparent in world output. The plan which has been recommended to China for the adoption of a gold

standard is a plan which anticipates that through many years to come China will gradually work toward this goal, but this does not mean the displacement of silver as a circulating medium but only that silver's value shall be stabilized on the basis of gold. A stable currency is essential to increasing business, and increasing business demands an increased circulating medium. The increase of civilization which always follows in the wake of a destructive war gives promise that silver is now seeing its worst day and that the future will surely bring about a condition in which the vast amounts of silver will be turned into the channels of trade as subsidiary coinage and that vast advances in civilization which means increased needs and increased consumption will add shortly to world trade through which every important nation will be benefited.

Anthracite Wage Agreement

THANKS to the wisdom of those who guide the anthracity industry, there will be no shortage of this fuel this winter because of labor difficulties. Wisdom, coordination and ability are clearly present in the recent agreement. The miners evidenced an intelligent appreciation of the needs of their industry and reason met reason in a sincere effort to smooth out any difficulties. In the past the representatives of the workmen have too frequently sacrificed ultimate well-being for momentary personal political gain. The result of such methods is plainly evidenced in the disorganization of markets.

During the past four years, when peace has existed in the anthracite region in regard to labor-contracts, the industry has been comparatively free to devote its energy to the newest of its problems—meeting competition. That it has been successful has been due in large measure to its satisfactory labor situation. For many years anthracite enjoyed a highly protected market. During that period it was fairly easy to pass on wage increases and the like to the consumer who was in a way compelled to use the product. But, this situation no longer exists. Our July issue presented the problems of this great industry and pointed out particularly their problem of a constantly diminishing market. Anthracite history is replete with labor difficulties. The recent long strike, which ended with the four-year truce now renewed, did more than any other factor to lose her markets.

Today the anthracite workmen have their check-off and the principle of arbitration and the right to a day in court for anyone who desires to be heard. The miners have further agreed "to cooperate with the operators for the promotion of efficiency." This means more than all that has gone before. The saving of material, the saving in labor, the reduction in overhead through increased production per man per unit working area—herein lies progress and success.

Modernization is the real need of the anthracite industry. The adoption of new and improved methods, coupled with the efficient sales and market plans of the operators, and peace in her labor relations insure the healthy future of this great industry.

At El Paso

THERE has been no time in the history of western mining when the problems confronting it were of greater importance. Silver is at its lowest ebb; gold is in little better shape; copper prices are below normal; lead and zinc are faced with many problems; curtailed production is the rule of the day.

Colorado's mines are "dreams of a by-gone day" unless something is done to better the situation. Utah, a silver state, finds her revenue from the mines diminishing; Nevada, New Mexico, California, the Coeur d'Alene—all—can stand a little more prosperity in their mineral production.

The mining industry, like all other industry, is confronted with the necessity to meet changing fundamental conditions; is obliged to meet new and different competition; must find new uses for its minerals; and must find ways and means to develop and utilize its great bodies of low-grade materials.

At El Paso, Tex., during the week of October 13, the western mining industry will meet. The sponsoring body is the Western Division of The American Mining Congress, but cooperating with it are the great organizations representing the technical and geological side of mining. The American Institute of Mining and Metallurgical Engineers, The West Texas Geological Society, The Mexican Society of Engineers, each will meet with the Congress in an effort to bring together all those forces working in behalf of the industry.

All of the major topics today engrossing western mining men will be discussed at the convention. In addition, an opportunity will be given to inspect some of the most interesting of the district's mines, and El Paso as host offers much not listed on the program.

Lightweight Alloys

PROGRESS in metals is shown in a material way by the recent issuance of the first Structural Aluminum Handbook to the trade, for the use of designers and purchasers of structural aluminum alloy shapes. This formal presentation parallels the procedure of steel merchandizing and constitutes the definite announcement that the light weight alloys have arrived. The ease with which workmen in mines, shipyards and industry in general will be able to handle the lighter materials brings a new thought in man shift performance and efficiency. For example, consider the handling of portable conveyors wherein the weight of sections in use at the present time will be reduced by two-thirds. With the employment of high priced labor in close places (as in mines) this means much, and as the months and years pass and the fetters of prediction are cast behind, it will mean more.

Another infant metal industry looms on the trade horizon in the increasing application and production of magnesium alloys. In the near future, magnesium too will have its Shape Book and its application will be welcomed by designers, engineers and workmen, alike. Education of these people in the desirability and use of the lighter weight alloys will create demand—with demand will come volume in production. Next and inevitably follow reductions in prices, permitting general use, and again the workmen of our country will forge ahead in results per man shift to offset the low wage labor of competitive nations. Our natural resources for the production of these metals are very great.

Congressional Seats and Mining States

WILL the 1930 Census result in a reorganization of the national House of Representatives, or will Congress deal with this situation in the same manner as 1920? The general thought seems to be that nothing will be done about the situation created by our growing population. If Congress carries out its own recommendations, extensive changes will take place in the lower house before the 1932 elections, which will effect materially some of the mining states. On the basis of the present figures, California would gain nine seats, Michigan four and Texas three. Mis-

souri would lose three, with Pennsylvania and Indiana also in the losing column.

According to a recent tabulation, the industrial East, including New England, would gain three representatives, the South and Southwest would lose five, the Middle West would lose eight, and the West would gain ten. Politically this has significance, and in that fact lies the question as to whether any action will be taken by Congress.

While sound government can not be predicated on numbers, the fact that the West would increase its manpower by 10 is interesting, and will appeal to that section of the country that has continuously harbored the notion that the industrial East rides too heavily in the congressional saddle.

Congressional "Do" and "Don't"

USUALLY after a session of our national legislature the statisticians are extremely busy in figuring out what Congress did and what Congress didn't do. The closing of the 71st Congress was no exception. We find this august body praised to the skies for what it did; cursed for what it didn't do; berated because of its lack of wisdom and cheered because of its vision. But cheered or kicked, it was a pretty good Congress and did no more or less than other Congresses before it.

On the whole, consider: There were introduced in both houses the staggering array of nearly twenty thousand bills—19,384, to be exact—to be considered in the period beginning April 15 and ending July 3! Approximately 300 measures per day if they worked every day, including Sunday. Giving the statistician an even better break, granting a day as eight hours, one bill must be considered every minute and a half!

But Congress didn't do quite that well. They considered and reported upon 3,227 bills and enacted into law 925 measures. Among these were the following:

Appropriated approximately $4,850,000,000 for the conduct of the Federal Government for year ending June 30, 1931.

Passed the Tariff Act of 1930.

Reduced income taxes approximately $160,000,000 on 1929 income.

Enacted a general disability pension system for World War Veterans and increased the level of Spanish-American War pensions.

Passed an omnibus Rivers and Harbors Bill contemplating future appropriations of approximately $400,000,000.

Made the Federal Radio Commission a permanent body.

Increased the annual Federal contribution to road building from $75,000,000 to $125,000,000.

Reorganized the Federal Power Commission, creating a new and permanent body of five full time members to succeed the Secretaries of Interior, War and Agriculture, who have heretofore had jurisdiction.

Passed legislation authorizing a $230,000,000 increase in the public building program.

Enacted a Farm Aid Law creating a Federal Farm Board and authorizing a $500,000,000 revolving and loan fund.

Passed an act providing for congressional reapportionment and authorizing the Fifteenth Decennial Census, now being taken at a cost of $13,500,000.

Passed a Licensing Law for dealers in fresh fruits and vegetables shipped in interstate commerce.

It should be remembered that the particular period referred to represents a typical session. Taking this as an example, is it any wonder that we need a Law Enforcement Committee?

Working Our Way Out

THE recent report of the Census Bureau upon the unemployment situation will do much to minimize the damage done to public morale by the more or less political statements as to the unsatisfactory state of our industrial life. Two percent unemployment is not as bad as we were led to believe.

There are two big factors continually facing industry. Over-production and under-consumption. How one may be curtailed and the other stimulated is an ever present problem.

In Europe, today, where their unemployment problem is decidedly worse than our own, considerable verbiage is reaching the ears of the world on what they term "rationalization" of industry. In this country, we call it "mechanization" of industry. Germany insists that the machine and its attendant efficiency improve the situation of labor as a whole, and states that she is now employing three million more men than before the war. England, on the other hand, fears the effects of the adoption of the machine; fears that it will increase her already wellnigh intolerable dole system. Some in the United States attribute our present depressed condition to the adoption of machine and mass production methods, and picture our labor on a dole, if we do not mend our ways.

A leading authority recently pointed out these pertinent facts in regard to mechanization: "It increases capital investment; it expands facilities for production; it requires less labor per unit of output; it demands volume production to keep down overhead costs; and it sometimes creates goods in excess of demand."

Granted! But, in increasing capital investment, it also decreases operating costs; in expanding facilities for production, it also permits greater volume at less cost; in requiring less labor, it is enabled to pay that labor higher wages; in developing volume—or mass—production, it enables the consumer to obtain the article in question at less cost; and in creating a situation that produces more than the demand, it forces uneconomically produced products off the market.

The situation of over-production without an adequate market is not a new problem in America. Every step in the development of her great mines, for instance, has led to greater production, and as the production has grown, science has found new industries, new uses, new methods, and the surplus created by efficient machinery has been consumed by new industry. In many instances the new industries have been created through the increasing demand for luxuries by well paid labor.

Whether we like it or not, mechanization, rationalization, or whatever we may call it, is to be the deciding factor in the future of industry. Well paid labor means prosperous industries. Industry can not pay its labor well when it is digging ditches with teaspoons, no matter how many men it employs.

Industry may be depended upon to work its way out in the present situation. It always has.

Burdens and Theoretical Reforms

MANY years ago a distinguished Senator thought he saw a necessity for a complete valuation of our railroads. It was to be made in order that the public might know the exact cost of transportation as a protection to itself against unfair freight rates.

Many years have elapsed and millions of dollars have been spent in this foolish effort to substitute the judgment of a few individuals for the law of "supply and demand."

The history of this country proves conclusively that whenever any business becomes too profitable that capital is available for the development of competition, through which the cost of any particular service is always brought to a proper level and frequently furnished below cost.

There is but one field in which competition may not be relied upon to protect the public against exorbitant rates. Wherever an industry is based upon a controlled natural product, it is possible for a large organization to gain control of a natural resource and for a time exact an undue price for its product. But even in this field exorbitant profits usually lead to the creation of substitutes, often as good, and frequently better than the original article.

In the case of public utilities, where a monopoly is essential to cheap production the public has the power to protect itself against exorbitant charges through State Utility Commissions.

There is a vast difference in the value of railroads. Each must perform service upon the competitive basis, fixed by other carriers, without reference to the cost to the railroad and whether the rate charged yields profit or a loss. If the valuation could have been perfected upon the plan originally outlined, it would have made but little difference to the public. Under this valuation law an effort was made to fix the original cost as the present value of the several railroads.

After many years of squandered effort the courts in the O'Fallon case decided that the present value of duplicate should be the basis upon which a railroad might be permitted to earn a fair rate. A desperate effort will be made to set this aside, but in the end it will be approved, because no other law would be just. Without question, the intentions of the reformer who started in motion this great extravagance were of the best.

At a later date the farming industry found itself operating under disadvantage. Congress undertook to assist by a requirement that rates should be based upon the necessities of the producer rather than upon the cost of service. The Hoch-Smith bill provided for a complete investigation of the basis of freight rates with the purpose of granting relief to the farmer. This relief could only be granted by placing an additional burden upon other industries.

The mining industry furnishes more than half the total tonnage handled by the railroads of the United States. In the search for a burden bearer, on the behalf of the farmer, the mining industry seemed a likely field for investigation. Under Docket 17000, hearings are now being held in the various western mining centers. It seems probable that the Interstate Commerce Commission, in conducting these hearings, will find that the mining industry is in greater need than the farming industry. Many mining towns have lost a large part of, and in some instances their entire population. Railroads are continually asking the privilege of taking up their tracks because the amount of ore which can be transported at the present freight rate does not justify the continuance of the service. This is not because there are not large beds of ore, which some day will be required by the industries of the nation, but that unlimited competition in the mining industry has forced down the price of metals to a point where low-grade ores cannot stand the cost of transportation and treatment charges.

In a recent hearing in Salt Lake City, Governor Dern pointed out "that silver had touched the lowest point in its history; lead is lower than at any time since 1919, except for the disastrous year of 1921; copper is down to pre-war levels, and zinc lower than lead, with no relief in sight. The price of gold, he said, is stationary, but the purchasing power has declined severely. It is, therefore obvious, that the metal mining industry is not enjoying an era of prosperity which enables it to assume added burdens."

Mr. A. G. Mackenzie, secretary of the Utah Chapter of the American Mining Congress, pointed out that "under such circumstances it will be necessary for the United States Government to safeguard its mining industry by fair treatment or the livelihood of thousands of persons engaged in mining will be jeopardized and agriculture's largest and best paying market will be crippled."

Undoubtedly the authors of these two costly investigations sincerely believed that good results would follow. The result, however, is that millions of dollars have been spent in expenses; years of turmoil and business disturbance have inured to the government; and the railroads have spent still more millions in defending themselves. Yet we wonder why transportation rates are high. Truly the reform is a costly luxury.

Magnesium

IN THE recent release of the Bureau of Mines on the production of the metal magnesium in the United States may be seen the romance of the growth of a promising young industry. Many of our readers will remember in their early school days witnessing the burning of a short length of magnesium ribbon. The pieces of ribbon were carefully stored in a stoppered bottle to lessen the tendency of the metal to oxidation as indicated by the white coating which formed on its surfaces. When touched by flame the magnesium ribbon burned rapidly with an intense white light, at the same time throwing off a white powder, the oxide. We were told that magnesium powder was useful for flashlight photography and for flares.

As the years have passed this demonstration metal of the lecture room and laboratory has been put to useful service in industry as a deoxidizing agent, and in recent years has entered, both in Europe and the United States, into the vastly important automobile and airplane fields. The properties of some of the alloys of magnesium are such as to permit of extremely gratifying reductions in the weight of automobiles and airplanes without sacrifice of strength of design. We are told that magnesium is the sixth most abundant element and that it is the third most abundant of the important industrial metals.

We note with interest the increase in production of metallic magnesium in this country of 155 percent in 1929 over 1928. What does this bid for the future?

The SILVER SITUATION

The silver situation as of June, 1930, and suggested action in regard thereto

By **Francis H. Brownell***

EIGHTY to ninety percent of the world's silver production is, and always has been, absorbed in use as money or its equivalent. But the story of silver for the last 60 years has been one of steady demonetization and lessened use as money. From prevailing prices of over $1 per ounce, it had sunk by the beginning of the War in 1914 to around 55 cents per ounce. With the destruction of confidence in the credit of various European governments that soon followed the War, accented by the demand of the Orient, especially of India, the price of silver rapidly enhanced. In 1918 England was forced to call upon the United States Treasury for 200,000,000 ounces of silver at $1 per ounce to settle her balances in India. Silver ultimately reached a high of over $1.32 per ounce in 1920.

In 1926, a Royal Commission on India's monetary system recommended that India go to a gold exchange standard and gradually sell on the open market the excess stocks of silver, consisting of several hundred million ounces then owned by the Indian government. At the time of publication of that report in the summer of 1926, silver was selling at about 65 cents per ounce. A rapid fall in the price followed, and in December of the same year the price averaged less than 53½ cents. From this level it recovered somewhat, averaging 56.37 cents for 1927 and 58.18 cents for 1928.

For a time after the War, when confidence in the monies of European nations had been so greatly destroyed, it seemed possible that a greater use of silver for monetary purposes would be necessary. But when the Royal Commission's report became known, this tendency stopped, and as, one by one, the European nations stabilized their currencies, they, one by one, either greatly reduced or entirely abandoned the use of silver for subsidiary coinage.

Owing to the internal dissensions of China and the existence of a state of practical civil war for several years last past, the interior silver hoards of China were drifting to Shanghai and these, with new purchases, caused stocks of silver at Shanghai to increase year by year. (See table I.) By 1929 they had become unprecedentedly high, causing a lessening demand by China. As India was a seller at this time, the price of silver began to fall steadily each month, from a high of 57 cents for January to a low of 48.47 cents for December, 1929.

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In early 1930, the Indian government placed an import duty on silver of 4 annas (between 9 and 10 cents U. S.) per ounce. This had quite a depressing effect, as it was interpreted to mean that the Indian government would adopt a policy of keeping the up-country Indian market to itself for the disposal of its stocks of government-owned silver.

In the early spring of 1930, it became known that the Kemmerer Commission, appointed to consider the type of money to be used in China, would recommend the adoption of some type of a gold standard.† As in the case of the Royal Commission's report in India in 1926, so rumor of a similar stand by China and the other causes above mentioned produced a rapid fall in the price of silver which, with a few rallies, steadily decreased until it reached 34 cents per ounce on June 4, 1930.

The fall in the price of silver of nearly 15 cents per ounce during the spring of 1930 caused a rapidly increasing demoralization of the exchanges, particularly of China and Mexico. The United States sells to China large quantities of cotton, machinery, oil, leaf tobacco and many other commodities.

Mexico and other silver using countries experienced a like disastrous effect from the fall in the price of silver. The purchasing power of all silver-using countries became seriously impaired and their ability to acquire commodities of the United States and leading European countries substantially lessened.

One-half of the entire population of the world is in China and India, not to mention Mexico and the many smaller countries which are, and always have been, accustomed to use silver as an important, if not primary, money metal. Their people are not accustomed to the use of banks, and their savings, large in the aggregate, are too small in the individual to permit of profitable handling by banks. They require large amounts of metal to supply their needs for saving, which in their case, means hoarding. Gold is inadequate for the purpose, because it is insufficient in quantity and will not subdivide into the small amounts representing the equivalent of 50 cents to $1 of savings made over a considerable period of time. Moreover, the people of these countries will not abandon their hoarding habits for a generation or more, and not until they are fully convinced of the permanent stability and dependability of the existing government. These people have been accustomed for ages to invest their savings in silver, and, as a result, India and China have accumulated during the centuries an enormous amount of silver. Few estimates are below seven billion ounces, and many higher. How is it possible for this enormous amount of value to be destroyed without most disastrous world-wide consequences? Quite possibly much of the present discontent and unrest in India and civil war in China have been brought about, or at least, accented, by

*Chairman of the Board of American Smelting and Refining Company.

† The Kemmerer plan for China's monetary system does not contemplate the abandonment of silver. It proposes to continue its use and, by a system of handling the exchanges, the amount of gold required will be reduced to a minimum and the parity of its fiduciary silver coin maintained.

Apparently no sale of silver by the Chinese government is contemplated, as was the case with India. The Kemmerer plan can be so handled in practice as to permit of the use of silver for much, if not all, of the internal business of China.

the evil effects on the prosperity and welfare of those countries, resulting from the rapid fall in the price of silver since the Royal Commission's report in 1926.

Present Production of Silver

In 1928 world production of silver was about 254,000,000 fine ounces. Of this, Mexico produced about 108,000,000 ounces, of which about 72,000,000 ounces, or approximately 66 percent, were derived from what might be termed strictly silver mines (that is, dry and silicious ores containing no copper or lead. Many of them contain some gold. They are principally treated by the cyaniding process).

In the United States, in 1928, out of a total production of 57,000,000 ounces, about 11,000,000 ounces, or 19 percent, were produced from strictly silver mines (dry and silicious ores).

In the balance of the world, about 18,000,000 ounces were derived from strictly silver mines (dry and silicious ores).

Summarizing, out of the total production in 1928 of approximately 254,000,000 ounces, about 101,000,000 ounces were from strictly silver mines (dry and silicious ores), or about 40 percent. Hence, about 60 percent of total production was by-product silver from ores chiefly valuable for copper, lead and zinc.

Silver from mines without copper, lead and zinc: In the United States practically all such silver mines are now closed, owing to the low price of silver.

In Mexico, which produces about 72,000,000 ounces per annum from mines of this class, a number of mines have closed down, owing to losses, but the process has been retarded because in Mexico the laws provide that mines can not be closed down unless (a) all employes are paid three months' wages in advance, and (b) the consent of the government is first obtained. The Mexican government has refused in most cases to permit the closing of mines, fearing that, from lack of employment, the miners will become desperate and turn to banditry as the only alternative from starvation.

The Secretary of Industry and Labor recognizes the critical situation, especially as regards the silver mines. He has pending 82 requests for suspension or reduction of operations, and is very much concerned about the welfare of the workmen. He has asked all applicants to do everything possible to keep going, as otherwise the situation may result in something quite serious. The Governor of the State of Chihuahua has already asked the Federal Government to send in corn to relieve the distressing condition there.

Already there has been organized what is called the Camara Nacional de Trabajo. Its principal purpose is to turn over to the workmen the mines as they are being closed down. It proposes that the owners of the mines shall turn over to the Cooperative (the workmen's committee) all of the supplies, equipment, tools and funds at the mine at the time of suspension. If the company has no funds, then its credit will be used to finance the work. This scheme may seem ridiculous and improbable, but, as a matter of fact, it is now working in Pachuca. The workmen took over a mine and a cyanide mill with over two tons of silver in solution and, contrary to the expectations of the owners, they have been able to eke out an existence. They pay no state taxes or power bills and get what dynamite and supplies they need wherever they find them.

But even if the mines are turned over to employes in Mexico, production must ultimately decrease, owing to less scientific methods, less managerial oversight, and to the various other factors which would enter into such a situation. Should the price of silver not increase, it is probable that Mexican silver production from silver mines proper should decrease during the year around 20,000,000 ounces per annum.

By-product silver: This amounted in 1928 to nearly 155,000,000 ounces as a world total.

Owing to the various amounts of silver produced in the different mines, it is difficult to reach anything but an approximation of the reduction in silver caused by the reduction of production of copper, lead and zinc. Considering all the data, it seems highly probable that production of by-product silver will be decreased for the last half of the year at least one-fifth, if not one-fourth.

Conclusion: It, therefore, seems probable that the production of silver for the last half of 1930 will be at a rate of not over 200,000,000 ounces per annum and will be less if the mines in Mexico now seeking to close or reduce are permitted to do so. This conclusion assumes that silver will stay below 45 cents per ounce.

Consumption of Silver

It has been authoritatively estimated that India and China for centuries have been slowly absorbing from 60 to 70 percent of the silver production of the world. During the war and until the Indian government began to sell its own silver to its own people, they absorbed more than this amount. Under the Pittman Act in 1918, 200,000,000 ounces from the United States treasury were sold to England, which, in turn, delivered it to India. Most of the silver received by England from debasing its currency was likewise sold to India. Large amounts of silver coming from Russia immediately following the Russian revolution found their way into India and China. India and China have together absorbed approximately 175,000,000 ounces of silver per annum since the war, most of which ultimately disappears through hoarding.

TABLE I—SILVER STOCKS IN SHANGHAI

(From Handy & Harman's Review for 1929)

(Fine ounces)

Year	High	Date	Low	Date
1929.....	197,820,000	11/2	145,680,000	1/5
1928.....	146,550,000	12/29	102,680,000	6/2
1927.....	141,470,000	5/21	107,700,000	12/31
1926.....	134,270,000	10/30	101,740,000	1/2
1925.....	114,810,000	10/31	86,770,000	1/3
1924.....	88,460,000	11/8	49,880,000	1/5
1923.....	67,650,000	5/5	44,850,000	12/15
1922.....	73,100,000	10/7	46,660,000	6/3

TABLE II—WORLD CONSUMPTION OF SILVER

(From Handy & Harman's Review for 1929)

(In millions of fine ounces)

	1929	1928
India:		
Imports from the United States, Canada, England, France, Egypt, Australia and others....	79.2	111.5
Supplies from Government reserves sold in India	7.3	.....
	86.5	111.5
Less Exports	4.7	22.5
Net Indian Consumption.....	81.8	89.
China:		
Imports from the United States, Canada and England.....	133.3	104.9
From India and Japan.....	3.4	19.1
Chinese consumption	136.7	124.
Germany:		
Imports from the United States, Mexico, England and others....	12.0	10.8
Arts and Manufacturers:		
In the United States and Canada.	37.0	33.5
In England	6.5	6.
Coinage:		
U. S. Mint	2.5	4.1
Poland	.....	6.5
Russia	3.5	1.6
Holland	3.	1.4
Hongkong Dollars	16.	.....
Unaccounted for	12.5	31.5
Total	311.5	308.4

WORLD PRODUCTION OF SILVER AND SUPPLIES FROM FORMER SILVER CURRENCY

(From Handy & Harman's Review for 1929)

(In millions of fine ounces)

	1929	1928
Production:		
United States	61.	58.4
Mexico	105.	108.5
Canada	22.5	21.9
All other countries	68.	68.4
Total Production	256.5	257.2
Other Supplies:		
Debasement of British coinage...	10.	5.5
Demonetized coin:		
French	10.	19.
Belgian	.....	13.
Sales by Indian Government.....	35.	22.5
Total	311.5	317.2

WORLD SILVER PRODUCTION

(American Bureau of Metal Statistics)

Year	Fine ounces	Year	Fine ounces
1913.....	225,686,823	1922.....	210,533,502
1914.....	178,331,493	1923.....	240,169,264
1915.....	189,626,405	1924.....	238,779,157
1916.....	180,112,525	1925.....	241,697,187
1917.....	187,443,658	1926.....	253,049,173
1918.....	204,199,399	1927.....	253,121,265
1919.....	181,800,394	1928.....	254,869,163
1920.....	173,200,618	1929.....	261,265,718
1921.....	171,873,246		

SILVER PRICES IN NEW YORK

(Monthly Average—American Bureau of Metal Statistics—In cents per fine ounce)

Month	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930*
January	88.702	101.125	132.827	65.950	65.450	65.668	63.447	68.447	67.795	55.795	57.135	57.019	45.000
February	85.716	101.125	131.295	59.233	65.290	64.313	64.359	68.472	66.773	57.898	57.016	56.210	43.193
March	88.082	101.125	125.551	56.023	64.440	67.556	63.957	67.808	65.880	55.399	57.245	56.346	41.654
April	95.346	101.125	119.779	59.337	66.575	66.855	64.139	66.899	64.409	56.399	57.395	55.668	42.428
May	99.505	107.135	102.585	59.810	71.154	67.043	65.524	67.580	65.075	56.280	60.298	54.125	40.736
June	99.500	110.430	90.957	58.510	71.149	64.861	66.690	69.106	65.481	56.769	60.019	52.415	
July	99.625	106.394	91.971	60.260	70.245	63.015	67.159	69.442	64.793	56.360	59.215	52.510	
August	100.292	111.370	96.168	61.597	69.417	62.793	68.519	70.240	62.380	54.718	58.880	52.579	
September	101.125	114.540	93.675	66.160	69.515	64.203	69.350	71.570	60.580	55.445	57.536	51.042	
October	101.125	119.192	83.480	70.970	68.015	63.649	70.827	71.106	54.505	56.035	58.087	49.913	
November	101.125	127.924	77.734	68.234	65.177	63.818	69.299	69.223	54.141	57.474	57.953	49.615	
December	101.125	131.976	64.774	65.760	63.905	64.705	68.096	68.889	53.466	57.957	57.335	48.475	
Year	96.772	111.122	100.900	62.654	67.528	64.873	66.781	69.065	62.107	56.370	58.176	52.998	

* From *Engineering and Mining Journal.*

SILVER PRODUCTION OF THE WORLD BY COUNTRIES *

(American Bureau of Metal Statistics)

(In fine ounces)

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
NORTH AMERICA:										
United States	55,361,573	53,052,441	56,240,048	66,163,338	64,221,655	61,377,977	60,918,000	59,412,000	56,149,000	60,180,000
Canada	13,330,357	13,543,198	18,626,439	18,601,744	19,736,323	20,228,988	22,371,924	22,736,698	21,936,407	23,180,155
Mexico	66,516,354	64,465,347	81,076,899	90,810,855	91,437,944	92,912,000	98,291,000	104,575,000	108,536,000	108,701,000
Total North America	135,208,284	131,060,986	155,943,386	175,575,937	175,395,922	174,518,965	181,580,924	186,723,698	186,621,407	192,061,155
Central America and West Indies	2,700,000	2,000,000	2,500,000	3,000,000	2,700,000	2,700,935	3,499,118	3,154,021	2,558,500	2,800,000
SOUTH AMERICA:										
Bolivia	2,223,690	2,441,060	5,373,559	5,212,843	4,857,608	5,174,000	5,834,003	5,402,840	5,638,756	5,700,000
Chile	2,604,396	2,558,940	2,709,141	3,337,474	3,033,225	3,261,682	3,251,490	1,504,700	1,436,719	*1,500,000
Colombia	480,000	500,000	3,150	3,150	2,900	2,900	125,953	131,417	68,228	*70,000
Ecuador	35,000	75,000	75,000	75,000	70,000	70,000	80,000	87,601	79,804	*80,000
Peru	9,196,282	9,853,910	13,169,765	18,654,362	18,717,087	20,746,909	22,523,036	18,381,987	21,817,697	21,163,000
Other countries	72,000	71,700	67,570	39,813	60,013	31,548	46,887	41,776	52,110	*50,000
Total South America	14,611,368	15,500,610	21,398,185	27,322,642	26,740,833	29,287,039	31,861,369	25,550,321	29,093,314	28,563,000
EUROPE:										
France	321,500	392,873	347,220	213,025	147,858	352,010	261,830	308,640	300,000	*300,000
Czechoslovakia	680,069	703,056	875,187	702,317	732,538	707,300	765,491	750,000	767,742	*800,000
Great Britain	76,344	12,229	29,885	34,625	31,153	32,439	41,345	46,714	32,761	*35,000
Germany†	3,305,020	3,387,420	3,615,525	3,883,945	4,787,521	5,291,890	5,629,140	5,293,433	5,221,160	5,465,000
Greece	220,935	192,900	184,123	195,000	160,750	254,274	254,300	241,125	350,000	*400,000
Italy	297,452	219,392	215,405	385,806	496,975	320,761	519,371	537,098	514,000	517,000
Norway	323,172	202,115	205,760	298,995	424,380	504,755	308,640	321,821	334,649	*350,000
Poland	†	†	†	†	†	†	†	193,865	223,089	376,702
Rumania	.....	96,450	62,821	64,300	72,209	76,581	93,685	140,688	99,986	*100,000
Russia	50,000	40,000	150,000	192,900	250,000	250,000	250,000	590,596	380,000	*400,000
Jugoslavia	15,000	15,946	26,813	24,562	31,250	26,106	45,010	53,755	61,085	*60,000
Spain and Portugal	2,956,546	2,679,349	2,778,210	2,842,060	2,879,965	3,303,863	3,000,656	3,056,565	2,526,443	2,500,000
Other countries	36,554	28,342	18,228	29,224	28,678	23,920	94,425	90,077	85,000	*90,000
Total Europe	8,282,592	7,970,072	8,509,177	8,866,759	10,043,277	11,143,899	11,183,518	11,624,377	10,895,915	11,393,702
OCEANIA:										
New South Wales	675,332	4,241,890	9,912,927	12,067,954	9,256,671	9,220,160	9,709,741	10,241,243	8,328,895	.....
Queensland	274,235	195,328	273,036	469,302	276,651	385,489	252,540	84,118	22,034	.....
Tasmania	623,359	348,658	794,585	638,602	642,158	730,194	766,653	741,782	669,326	.....
Other states	137,928	122,804	128,186	115,352	94,379	84,766	71,139	56,039	116,454	.....
New Zealand	454,000	454,000	376,000	527,491	500,023	494,482	425,287	427,358	445,811	.....
Total Oceania	2,164,854	5,362,680	11,484,734	13,818,701	10,769,882	10,915,091	11,225,360	11,550,540	9,582,520	10,500,000
ASIA:										
India	2,906,397	3,587,587	4,244,304	4,863,066	5,309,203	4,854,923	5,124,962	6,024,806	7,425,810	7,300,000
China	50,000	40,000	100,000	100,000	110,000	110,000	135,000	100,000	100,000	*100,000
Chosen (Korea)	1,200	2,958	10,835	39,281	54,662	70,299	51,927	52,000	50,000	*50,000
Dutch East Indies	1,027,956	1,021,994	1,109,657	1,408,973	2,083,256	2,385,016	2,363,829	2,285,801	2,031,976	*2,000,000
Japan	4,889,540	4,185,504	3,886,301	3,597,264	3,542,255	4,059,340	4,476,952	4,531,446	5,000,000	4,999,600
Turkey	100,000	100,000	8,037	8,037	219,906	219,900	225,050	225,050	220,000	*220,000
Other countries	25,179	29,962	23,890	23,437	11,008	13,162	14,314	25,159	25,000	*25,000
Total Asia	9,000,272	8,968,005	9,383,024	10,040,058	11,330,290	11,712,640	12,392,034	13,244,262	14,852,786	14,694,600
AFRICA:										
Algeria	150,000	.....	.....	.....	.....	96,450	169,141	118,087	117,412	*120,000
Rhodesia	164,865	161,383	179,399	161,492	401,277	157,971	153,990	131,598	103,890	89,482
Transvaal, Cape Colony and Natal	892,593	830,329	1,115,676	1,373,930	1,396,943	1,161,470	981,333	1,011,736	1,031,376	1,031,779
Other countries	25,790	19,181	19,921	9,745	733	2,727	2,386	12,625	12,043	*12,000
Total Africa	1,233,248	1,010,893	1,314,996	1,545,167	1,798,953	1,418,618	1,306,850	1,274,046	1,264,721	1,253,261
Total for World	173,200,618	171,873,246	210,533,502	240,169,264	238,779,157	241,697,187	253,049,173	253,121,365	254,869,163	261,265,718

* The basis of this table is the information published by the Director of the Mint. However revisions and additions have been made so that the totals do not agree with the Mint figures. For 1929 the figures are based on actual reports or reliable estimates, except where the asterisk is used, indicating that the figure is conjectural. † Polish production included with Germany, 1920-1926.

We may roughly approximate the consumption of silver under normal conditions about as follows:

	Ounces
World production, say	250,000,000
Absorbed by the arts	40,000,000
Absorbed by India and China	160,000,000
Balance to be otherwise disposed of, say	50,000,000

Fifty million ounces is a small amount to be taken by the other nations of the world for coinage purposes, or to be otherwise absorbed.

But, owing to the civil war in China and to the fact that India and China have absorbed very large amounts of silver in the last two or three years, and that excess stocks have accumulated at Shanghai, it may happen that the consumption of silver of these two countries in the next year or so will be at a lower level.

A great danger lies in the fact that many of the wealthy and most enlightened holders of large hoards of silver in India are becoming fearful of the

future of silver. They see their own Government and other European nations selling their silver. "A flight from silver" may begin in India and China, much as a "flight from the mark" prevailed in Germany a few years ago.

What Can Be Done?

Agitation for relief by legislation of various types by the United States Congress or by foreign nations seems wasted effort at this time. Contemporaneously with the fall in the price of silver, a similar fall has occurred in the prices of most of the raw commodities—not as drastic on an average as in the case of silver, but in the case of individual commodities fully as drastic. Under such conditions, it would be impossible to successfully single out silver for special legislative relief.

Nor would an International Conference at this stage be of benefit. The political situation in India is most delicate, and now is not a time when the question can be considered with any prospect of concrete action by way of legislation. A suggested International Conference would undoubtedly bring up the ever impending question of the League of Nations (since the economic branch of the League is now investigating the subject), which would make it difficult for the United States to take an active part without a further stand on this delicate and highly controversial subject.

The ultimate solution of the problem is so closely allied to the sufficiency of gold to do the work of the entire world, if on a gold basis, that it seems probable it must await further experience and the development of time. But for the amelioration of present conditions, it seems imperative that such helpful remedies as are available should be immediately applied. Among these are the following suggestions:

(1) India and all European or other Governments might cease the further sale of silver, retain in their treasuries what they now hold, and publicly announce such a policy.

A consideration of the amount of silver purchased annually by India and China (shown in *Table* 2) indicates that, with the cessation of sales by Governments, the new mine production of silver would probably be fairly easily absorbed.

(2) The use of silver for all internal purposes in India and China might be fostered. This does not prohibit or impair the desired benefits of a gold exchange standard for foreign trade, nor prevent those countries, so far as foreign trade is concerned, from adopting such method as that suggested in the Kemmerer report.

(3) The duty on silver into India might be removed to permit of natural absorption by that country.

(4) The Mexican Government might not place restrictions on the closing of such mines as can not economically operate at present levels.

(5) The United States, England, France and other European countries might, to the extent that present laws permit, enter the market for silver for subsidiary coinage purposes, whenever silver is at a level of below 40 cents per ounce.

(6) Above all, there should be concerted action between England and the United States in the first instance, and as rapidly as possible, France, Japan, Germany and other European nations should be informally tied in to such helpful action in the use of silver as is possible under present laws. Should arrangements informally be made, under which India and the other Governments would announce a discontinuance of further sales of silver, much would be done to restore confidence in its future and to prevent the spread of the "flight from silver." Should such action be followed by some buying on the part of nations, particularly of the United States and England, of silver for subsidiary coinage, and by evidence that the leading nations were acting concertedly in an effort to prevent further demoralization of silver, confidence in its future would be largely restored, the fall in price would cease and probably a reaction towards higher levels shortly follow, especially if new mine production falls as much as now indicated.

Summing Up: The recent fall in the price of silver was due to an excess of supply over demand. Excessive supply was in part due to an unusually large mine production of silver in 1929, and very largely due to the sale of old silver formerly held by Governments. A fall in price rapidly affects production, and, as above stated, it seems probable that production will shortly be at a level of around 200,000,000 ounces per annum, or a decrease of 20 percent. Never before has it been impossible for a production of 200,000,000 ounces per annum to be readily disposed of in India, China and in the arts. An accumulation of excess stocks at Shanghai may delay the normal process in this instance, but not for long. The possibility of silver returning again to its former levels is largely, if not entirely, dependent upon whether the Indian Government and perhaps other Governments pursue the policy of throwing silver upon the market whenever prices strengthen. If this policy were stopped, it seems highly probable that silver would ultimately recover. If it continues, it is impossible to predict the final outcome.

A hopeful note is sounded in the speech of Sir George Schuster before the Legislative Assembly on March 22, 1930, when he is reported to have said:

> "We have sold, in the last three and one-half years, 67 million ounces of silver at an average price of just over 25½d. an ounce. * * * We have sold nothing below a price of 22½d. (roughly, 45 cents U. S.), and silver today in the world stands at just over 19d. and as I have said, we have sold no silver at all in the market since the 13th of December. *I think that I am justified in claiming that that gives us some right to ask the public to have confidence in us as to our future policy in the matter.*"

If this language can be properly interpreted to mean that the Indian Government will not sell silver below 22½d. (45 cents) per ounce, there is good reason to hope that, with the probable reduction in production now indicated, silver will, in due course, react towards a higher level—how rapidly time alone can demonstrate. Something will depend on the attitude of European Governments in selling silver and something will depend on the situation in China. If relative peace reigns in China and the stocks at Shanghai are not thrown on the world market for war purposes, the reaction to higher levels will be much more assured.

FILM STORY OF STERLING SILVER

The story of the manufacture of the silverware is depicted interestingly in a new motion picture film recently completed by the United States Bureau of Mines, in cooperation with a large manufacturing concern. The film, which comprises three reels, is entitled "Silver: Heirlooms of Tomorrow."

The charm of a finished piece of silver depends on design, craftsmanship, weight and finish, thus designing comes first.

Silver comes into the factory as ingots, sheets or wire. The first step in reproducing the artist's design is the making of steel dies for stamping or models for casting. In making flat ware, blanks are stamped from sheet silver. Successive processes by which forks, spoons and other articles are shaped from these blanks are flashed upon the screen.

Copies of this motion picture film, "Silver: Heirlooms of Tomorrow," may be obtained for exhibition purposes by schools, clubs, churches, civic and business organizations, miners' local unions and other organizations, or persons interested. Applications should be addressed to the Pittsburgh Experiment Station of the United States Bureau of Mines, 4800 Forbes Street, Pittsburgh, Pa. No charge is made for the use of the film, but the exhibitor is asked to pay transportation charges.

GOLD PRODUCTION and its Future

By **H. A. Kursell***

GOLD production from 1493, that is, since the discovery of America, to 1930, has amounted to approximately 1,042,850,000 ozs., of which about 555,350,000 ozs. or slightly more than one-half, have been produced during the twentieth century. Of the total amount produced, roughly 500,000,000 ozs. or about 48 percent, are represented by monetary stocks, the balance of 542,850,000 ozs. having been absorbed by industry, lost, or disappeared by hoarding.

* Resident Engineer in New York City of American Smelting and Refining Company.

Figure 1, from U. S. Dept. of Commerce Economic Paper No. 6, 1929, shows the average annual world production of gold by decades, from 1801 to 1930.

Figure 2 shows the distribution of gold production by continents. *Figure 3*, the political control of gold production. In 1929, the United States controlled 10.8 percent of the world output and the British Empire 71.4 percent. A further change in favor of the latter seems likely.

World production in 1928 was 19,674,638 ozs. 14,298,880 ozs. were coined in that year, and 4,642,592 ozs. were absorbed by industry in the main consuming countries for which reports are available.

The Transvaal output in 1929 amounted to 10,414,066 ozs., or about 51 percent of the total world production, the record for this field.

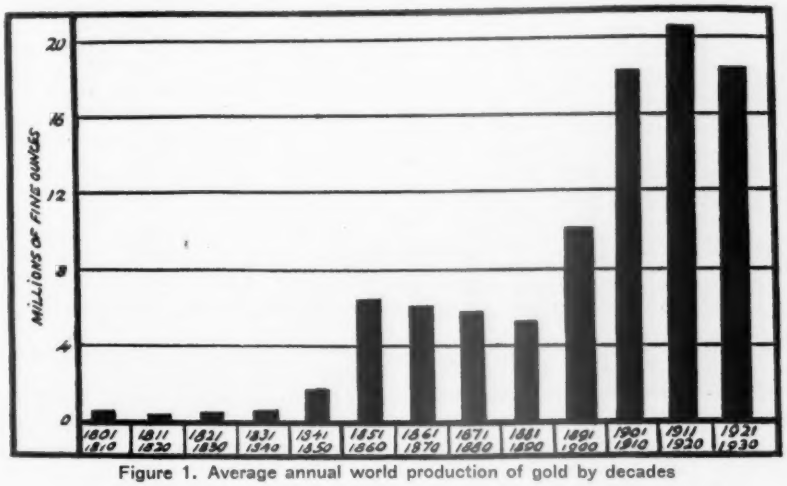


Figure 1. Average annual world production of gold by decades

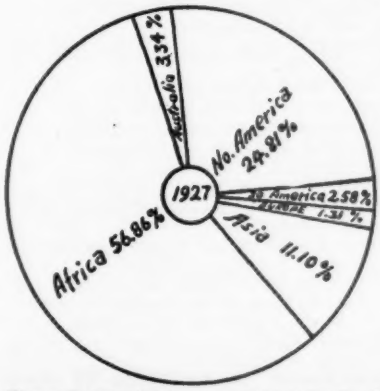


Figure 2. Distribution of gold production by continents

Figure 3. The political control of gold production

Transvaal or Rand

The Rand gold deposits were discovered in 1885, and by 1899 gold production had risen to 3,637,713 ozs. It declined to 348,761 ozs. in 1900, owing to the Boer war. Its further development is shown by the figures in Tables II and III.

Attention is called to the number of mines that have ceased operations during the period between 1909 and 1929.

The large mines of the Rand are gradually attaining great depth. The maximum in 1925 was 6,300 ft. vertically below surface. By June, 1930, the Village Deep, for instance, will have reached a vertical depth of 7,640 ft. Further extension of workings in depth must be considered extremely remote.

Among the factors which increase the difficulty of working mines at increasing depth are hoisting, rock pressure and temperature. The most critical of these is at present the increase of temperature with depth.

Whereas the normal temperature rise is considered 1 degree F. for 219 ft. vertical depth, the corresponding figure for the Rand is 1 degree F. for every 254 ft. vertical depth. The probable rock temperature at 8,000 ft. vertically below surface, therefore, will be 100 degrees F. Experience has shown that it is not possible to keep the temperature at the bottom of the intake where the air is split to the several workings at less than 10 degrees below the temperature of the virgin rock; in drifts, main raises and haulage ways—at less than 7 degrees, and in stopes at less than 4 degrees F. below the temperature of the virgin rock.

At about 80 degrees F. saturated air and 100 degrees F. dry bulb, the approximate limits are reached of successful operation of the human body's thermostatic control when at work. Increased air circulation at high temperature, particularly if above body temperature, only adds to the discomfort. Amelioration of conditions can be obtained by lowering the moisture content of the air. Dehumidifiers have been tried in several places and refrigerating units are being used with some success for the lower levels of the Morro Velho mine of the St. John del Rey Mining Company in Brazil where on the lower levels (7,500 ft.) the temperature had reached 120 degrees F. with 60 percent moisture. The Morro Velho, however, is a relatively rich mine (ore reserves as of January, 1929, 1,171,537 tons assaying $14.58 gold per ton),

TABLE I—WORLD PRODUCTION OF GOLD, BY YEARS, FROM 1880 TO 1930

(Fine ounces)

Year	Production	Year	Production
1880	5,349,158	1905	18,488,085
1881	5,064,313	1906	19,533,892
1882	4,885,626	1907	20,039,853
1883	4,746,390	1908	21,483,983
1884	5,014,923	1909	22,093,602
1885	5,102,414	1910	22,146,716
1886	4,944,835	1911	22,466,812
1887	5,255,917	1912	22,670,332
1888	5,508,562	1913	22,306,558
1889	6,048,352	1914	21,319,747
1890	5,814,182	1915	22,718,154
1891	6,300,233	1916	22,035,302
1892	7,060,290	1917	20,297,144
1893	7,543,737	1918	18,568,278
1894	8,657,113	1919	17,667,308
1895	9,518,192	1920	16,335,420
1896	9,716,749	1921	16,003,616
1897	11,396,952	1922	15,467,223
1898	13,920,747	1923	17,802,109
1899	15,073,419	1924	19,033,459
1900	12,420,942	1925	19,025,942
1901	12,692,227	1926	19,349,118
1902	14,494,382	1927	19,397,757
1903	15,934,268	1928	19,674,638
1904	16,902,209	1929	20,191,478

TABLE II

Year	Production
1905	4,909,541 ozs.
1910	7,527,108 "
1915	9,093,902 "
1920	8,158,228 "
1925	9,597,573 "
1929	10,414,066 "

whereas the Rand mines exploit ore assaying $6.59 per ton and yielding a profit of only around $2.00, which does not leave much margin for expensive air conditioning. The rigorous Miners' Phthisis regulations demanding abundant use of water sprays in the Transvaal make dehumidifying of the air difficult. By a change in these regulations a slight improvement might be obtained. Nevertheless, 8,000 ft. may be considered the ultimate depth to which economic mining at the Rand seems feasible.

On the East Rand the banket forms a syncline, dipping more flatly here (30 degrees) than in the Central Rand, and some of the mines (Brakpan, for instance) are working at a depth of 20,000 ft. along the dip below the outcrop. A maximum vertical depth of 6,000 ft. seems likely here for geological reasons.

As regards the "known" Rand, that is, the area comprising the 36 mines now producing, Dr. Pirow, South African Government Mining Engineer and President of the South African Geological Society, stated in his presidential address in August, 1929, that the estimated reserves of probable tonnage in the Rand were 320,000,000 tons, and he allowed for prospective tonnage in undeveloped areas, etc., 180,000,000 tons of possibly payable ore.

In addition hereto, according to a statement by Sir Robert Kotze made in the South African Assembly early in 1930, there are estimated to exist about 440,000,000 tons of rock containing 3.50 to 4.50 dwts. (or dollars, figuring gold at $20.00 on ounce), per ton which are not at present workable. Average working costs in 1929 were 19s. 10d. or $4.82, as compared with 18s. 6d. ($4.50) in 1913. The possibility of making this rock commercially exploitable seems, therefore, rather remote.

TABLE III—COMPARES ORE RESERVES AND GRADES AS OF 1909, 1919 AND 1929, RAND ORE RESERVES

(In long tons)

	1909		1919		1929		Stoping width inches
Aurora West	339,000	$5.85	.....	$....	.....	$....	.....
Bantjes Consolidated	958,440	7.60	.....	....	.....	....	.....
Benomi Consolidated	606,117	6.47	.....	....	.....	....	.....
Brakpan Mines	1,720,181	6.56	2,484,000	8.79	2,531,440	7.89	57.61
Cinderella Consolidated	421,984	6.78	.....	....	.....	....	.....
City Deep	2,273,187	8.20	3,418,050	9.4	1,809,000	6.31	51.2
City and Suburban	828,936	6.88	.....	....	.....	....	.....
Cons. Langlaagte	401,317	6.37	2,090,300	6.25	.....	....	.....
Cons. Main Reef	.....	.....	1,200,900	7.6	1,985,700	7.5	41.7
Crown Mines	6,282,719	7.60	8,451,400	6.3	10,841,460	6.66	46.4
Durban Roodepoort Deep	867,551	6.70	1,077,500	6.6	2,059,300	7.28	43.3
East Rand-Prop. Mines	.....	.....	2,634,350	6.3	3,414,270	6.3	55.0
Ferreira	598,671	8.10	.....	....	.....	....	.....
Ferreira Deep	1,779,328	9.60	807,880	8.2	.....	....	.....
Geduld Proprictary	44,600	9.09	2,580,000	7.4	6,100,000	6.5	60
Geldenhuis Deep	2,521,481	6.10	1,375,200	5.9	760,300	5.66	55.6
Ginsberg	341,207	6.50	.....	....	.....	....	.....
Glencairn	1,120,607	4.00	.....	....	.....	....	.....
Government Areas	.....	....	11,001,700	8.6	10,973,000	8.9	65
Jupiter	1,074,000	5.80	.....	....	.....	....	.....
Knight Central	700,000	6.00	.....	....	.....	....	.....
Knights Deep	1,700,000	5.50	997,000	4.8	.....	....	.....
Langlaagte Est.	1,267,769	....	1,002,400	6.5	1,567,500	7.1	42
Lancaster West	431,000	6.76	.....	....	.....	....	.....
Luipardsvlei Est. & G. M. Co.	.....	....	.....	....	924,300	5.4	42.3
May Consolidated	300,475	....	.....	....	.....	....	.....
Meyer & Charlton	249,326	8.60	.....	....	43,301	5.1	42
Modderfontein B.	2,788,000	7.00	3,215,100	9.0	1,445,400	7.3	51.0
Modderfontein Deep	.....	....	3,775,000	9.1	3,000,000	8.9	79
Modderfontein East.	.....	....	850.000	8.	2,045,400	6.1	46.5
New Modderfontein	2,581,744	7.10	8,854,300	8.5	9,097,600	8.6	50
New Goch	741,688	5.34	.....	....	.....	....	....
New Kleinfontein	1,397,412	6.46	2,312,000	5.53	531,000	4.9	54
New Heriot	485,585	8.41	.....	....	.....	....	.....
New Primrose	490,809	7.80	45,500	6.4	.....	....	.....
New State Areas	.....	....	.....	....	2,678,000	8.7	51
New Unified	285,174	6.80	149,000	6.5	.....	....	.....
Nourse Mines	2,142,047	6.50	1,526,100	6.8	1,066,700	5.9	43
Randfontein Central	6,573,637	....	3,802,000	6.3	.....	....	.....
Randfontein Estate	.....	....	.....	....	4,196,800	5.8	42
Roodepoort United	617,735	5.47	.....	....	.....	....	.....
Rose Deep	3,553,474	6.10	3,031,280	5.2	714,300	4.8	65.0
Robinson	1,444,189	11.77	115,200	....	.....	....	.....
	2,202,437	4.24	.....	....	.....	....	.....
Robinson Deep	1,050,000	7.23	1,583,000	6.59	1,307,000	6.0	60
Simmer Deep	1,255,000	5.01	836,000	5.1	.....	....	.....
Simmer East	950,000	5.40	.....	....	.....	....	.....
Simmer & Jack	2,690,000	6.30	.....	....	1,581,000	5.9	48
Springs Mines	.....	....	.....	....	3,250,238	9.3	52.50
Sub Nigel	.....	....	342,000	10.3	922,000	18.0	22
Van Ryn Deep	.....	....	3,200,000	9.1	3,110,700	7.4	50
Van Ryn Estate	.....	....	1,287,520	5.7	1,323,976	4.5	.....
Village Deep	1,943,593	6.10	2,389,700	6.3	1,544,600	5.7	54.4
Village Main Reef	1,775,175	....	.....	....	.....	....	.....
West Rand Cons.	1,124,631	5.54	.....	....	3,502,000	5.6	49
West Springs	.....	....	.....	....	2,752,680	6.34	61.16
Witwatersrand	.....	....	.....	....	647,300	6.2	.....
Wit. Deep	1,232,784	5.78	1,142,500	5.9	617,078	6.0	.....
Wolhuter	759,969	6.41	693,894	5.7	.....	....	.....

The 36 producing mines on the Rand milled in 1929 31,044,500 long tons of ore, yielding 0.3396 ozs. per long ton. The average yield in 1917 was 0.3300 ozs. per long ton, which indicates a marked regularity of grade.

The average width of the banket is from 4. to 4.5 ft. (max. average for individual mines—79 inches, minimum—22 inches). Therefore, to produce the above tonnage, roughly 90,000,000 sq. ft. or 2,250 acres of productive reef area have to be stoped annually, and there are sections where the reef pinches or is below commercial grade. This figure illustrates the scale of operations which will exhaust in measurable time even a deposit that is known for over 80 miles along the strike.

A. Lewis, in the South African Mining Review (November, 1929), estimates the life of the various Rand mines as follows:

*Brakpan Mines—16 to 25 years.
*City Deep—20 to 25 years.
*Consolidated Main Reef—14 years at least.
*Durban Deep—15 to 25 years.
*E. R. P. M.—20 to 30 years.
Geduld—15 to 20 years.
Geldenhuis Deep—4 to 8 years (possibly even 10).
Government Areas—15 years.
Langlaagte Estate—10 to 14 years.
Luipaardsvlei, 20 years (probably).
*Meyer & Charlton—a few years.
Modder B—7 to 9 years.
Modder Deep—8 to 10 years.
*Modder East—12 years (possibly much extended).
*New Kleinfontein—(properties can be worked by other companies).
New Modder—14 years (possibly a further few years on low grade ore).
New State Areas—15 to 17 years.
*Nourse Mines—14 to 18 years (further areas obtainable).
*Randfontein Estate—14 to 18 years (even over 30 possible).
*Robinson Deep—14 years (amalgama-

tion with Village Deep would help both companies).
*Rose Deep—5 years.
*Simmer and Jack—12 years (and over).
*Springs Mine—12 years.
*Sub Nigel—24 to 30 years.
*Van Ryn Deep—10 years.
Van Ryn Estate—? (may yet live for some years).
*Village Deep—5 to 7 years.
*West Rand Consolidated—(probably over 20 years).
*West Springs—9 to 10 years or more.
Witwatersrand—(a few years more).
Wit. Deep—5 to 7 years.

As in every great mining field, there are optimists who see vast possibilities for an extension of the Rand, particularly in the east beyond the present Far East Rand mines, and likewise to the west. The consensus of more balanced opinion, however, seems to be that if the Rand mines continue crushing on an annual basis of 30,000,000 to 32,000,000 tons, the Rand production will remain more or less stable around 10,000,000 ozs. for the next four to five years, but by 1936 a decline of 30 percent is to be expected. (Sir Robert Kotze, engineer for the South African Government, estimates a decline of 48 percent by 1936), which is likely to increase gradually as the present probable and prospective ore reserves will be exhausted by 1947.

While the Transvaal is likely to continue as an important gold producer even after 1950, its contribution to world production, however, will be on a much smaller scale than heretofore.

United States

The United States, with 10.8 percent in 1929, ranks as second gold producer of the world. Its production has steadily declined since 1915, when it reached its peak with 4,823,672 ozs., to 2,128,027 ozs. in 1929.

Of the 25 largest producers listed in 1927, six had practically suspended operations at the beginning of 1930. The Homestake in South Dakota remains the premier gold mine in the U. S. A., milling about 1,600,000 tons per annum and recovering $3.65 to $3.75 gold per ton. The reserves of the property are estimated at around 16,500,000 tons.

The fact that no new large gold mines (Fairbanks excluded), have been developed in Alaska in the last decade, has caused general disappointment.

It seems likely that the United States will maintain its production around 2,000,000 ozs. per annum for some time to come. No appreciable increase is expected.

Canada

Canada, whose production has increased from 773,178 ozs. in 1914 to 1,914,920 ozs. in 1929, is likely to wrest second place as a world producer from the United States in the near future. It may possibly attain a production of 2,500,000 to 3,000,000 ozs. per annum.

However, the output of the largest Canadian gold field, Porcupine, is declining. The production of the Hollinger Mine declined in 1929 from $11,000,000 to $9,000,000. Ore reserves for this property, as of December 31, 1927, were given at 4,789,438 tons assaying $9.89 per ton. The McIntyre ore reserves, as of December, 1928, were given at 1,546,754 tons assaying $8.45 gold per ton. The Dome seems to be nearing its end. The Wright Hargraves and Kirkland Lake gold mines do not publish figures on ore reserves.

Russia

Russia, contributing about 1,000,000 ozs., or 5 percent of the world total, holds fourth place as a gold producer.

It has recently become the fashion among people interested in the future outlook of gold production, to credit Russia with vast potentialities. The U. S. Department of Commerce, Bureau of Mines, Economic paper No. 6, published in 1929, summarizing on page 62 the outlook for future gold production, speaks of Russia's "vast unexplored and undeveloped precious metal resources." The last issue of Mineral Industries (1928), a standard handbook, quotes on page 242, Boris P. Torgashoff, in the *China Weekly Review*, March 9, 1929, stating that the Russian Far East contained untapped gold reserves exceeding 6,000,000 kgr. (193,200,000 ozs.) and Northern Manchuria—3,500,000 kgr. (112,700,000 ozs.). Such statements have no foundation in fact and probably would not be made if those responsible for them were better acquainted with the original language and with the mineral nature of the country of which they speak.

Russia has been, and to some extent it still is, the placer country "par excellence." Less than 10 percent of its production has come from lode mines, all of which are small. The placers, on the whole, were likewise small, shallow, but fairly highgrade, *i. e.*, preeminently suited for mining operations on a small scale. Individuals or small groups of individuals working entirely without capital, chiefly as lessees or tributors, produced even in 1912 62 percent of the total Russian gold output (1,880,100 ozs.).

The major part (77 percent) of Russian production came from Eastern Siberia. The largest gold mine in Siberia, believed to have been the largest and richest placer mine in the world, is the Lena Goldfields. The rich deep channels for which Bodaibo was famous ($16.00 to $20.00 per cu. yd.) have mostly been exhausted. Ore reserves in 1928 were estimated at 110,000,000 cu. yds. of dredging ground, valued at 36.6 cents per cu. yd. Incidentally it may be mentioned that C. W. Furington, in 1916, estimated the available dredging ground at 324,172,800 cu. yds. Allowing for undeveloped and unprospected areas, the expected optimum for this district might be 500,000,000 cu. yds. containing perhaps 10,000,000 ozs. gold.

There are some dredging possibilities, though on a small scale, on the Zeya River and other tributaries of the Amur, in the Yenissei basin, and in the Maritime Province; but the vast majority of placer ground in the Urals, the Tomsk and Semipalatinsk districts, and in the Far East, contained only shallow and small deposits, most of which have been exhausted.

It seems likely that Russia's gold production will remain around 1,000,000 ozs. per annum for a considerable time to come, but no expectations of a large increase, sufficient to influence world production, are warranted.

It may be added here that Russia has been much more thoroughly prospected and its mineral resources are very much better known than is generally accepted.

Other Countries

A study of the gold mines and prospects in the other gold producing countries, *i. e.*, Mexico, Central and South America, Australia, New Guinea, Rhodesia, West Africa, British India, Japan (including Korea), and China, reveals that no appreciable increase in world production can be expected.

With exception of the Transvaal (10,414,066 ozs. in 1929), Canada (1,914,920 ozs. in 1929), and Japan (507,000 ozs. in 1927), gold production in most countries has been steadily declining.

Production declined—

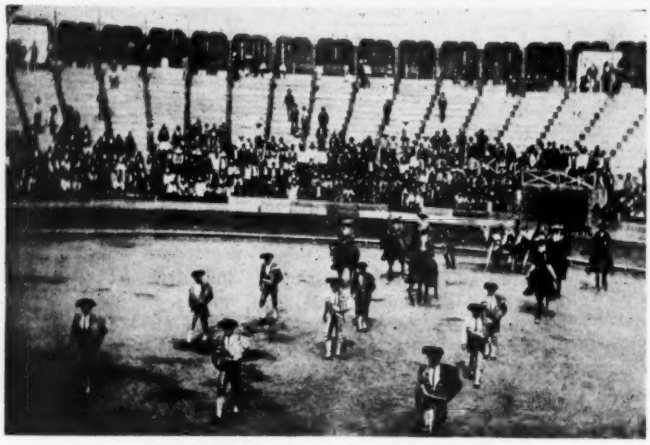
In Rhodesia—from 652,791 ozs. in 1922 to 560,813 ozs. in 1929.
West Africa—from 419,510 ozs. in 1914 to 175,100 ozs. in 1929.
Western Australia—from 553,833 ozs. in 1921 to 377,164 ozs. in 1929.
India—from 541,086 ozs. in 1916 to 363,271 ozs. in 1929.
Mexico—from 1,205,000 ozs. in 1910 to 725,175 ozs. in 1927.

This is not meant to say, however, that no new large and profitable gold mines will be found in these countries. The contrary is quite possible. A certain revival of gold mining is expected in Australia; lode and placer mining seems promising in New Guinea; production in South America is likely to increase within the next few years, though it is generally held that exploration in the Andes has progressed to a point which suggests the probability that no large gold mines are to be found there.

Nevertheless, it may not be amiss to point out that the opening up of a few new large (*Continued on page* 692)

* Companies that can secure more claims and life.

EL PASO, TEXAS



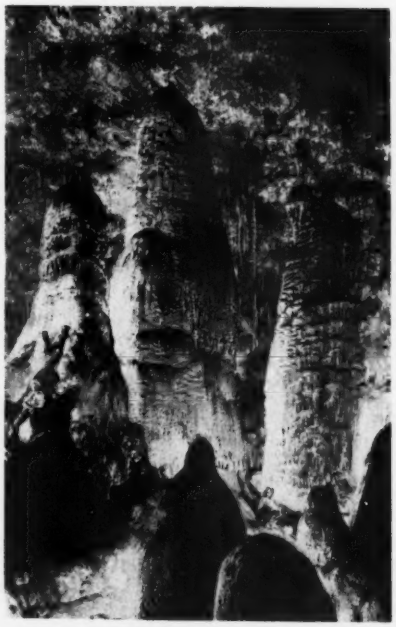
Gateway to the Vacation Lands of the Scenic and Sunny Southwest

HE WHO has sipped the waters of the Rio Grande, or has breathed the alkali dust of the desert, knows the lure that this great southwestern country holds. No matter where he may roam, to what foreign shores he may sail, always will that part of the Southwest that he has taken into his veins call him back to her. Cacti-covered plain, mountains both barren and pine covered, gorgeous sunsets and the whispering of night winds on the desert will be forever a part of him. Nor can he die content unless he visits it once more.

El Paso, convention city of the Western Division of the American Mining Congress, is the gateway to this great and varied vacation land of the scenic and sunny Southwest. El Paso and its sister city, Juarez, Mexico, are full of many points of scenic and historic interest for the visitor. First visited by white men before the landing of the Pilgrims, the Spanish influence is to be seen vividly in both of these border cities, the largest on the United States-Mexico frontier.

El Paso, built in the lowest snow-free pass of the Rocky Mountains at an elevation of 3,762 ft., has grown to a modern city from a little 'dobe village in little more than a quarter of a century. Here is located Fort Bliss, the largest cavalry post of the United States Army. One of the big events of the year at the Fort is the annual horse show and polo tournament held in the fall.

Down the Rio Grande Valley from El Paso are three old missions at Ysleta, Socorro and San Elizario, built in 1683 after Spanish settlers, who had fled from hostile Indians in the Santa Fe district in 1680, had reestablished themselves in this valley. The scenic drive across the nose of Mount Franklin affords a marvelous view of the city, valley and Old Mexico. Three states can be seen from the topmost point of the drive—New Mexico, Texas and Chihuahua.



In Juarez, the visitor is in a foreign land. Here the modern rubs elbows with the ancient. Old customs still prevail. Centuries old types of architecture are to be seen here. Among the many points of interest in Juarez are:

The bull ring, where bull fights are held at regular intervals. On the same spot where the bull ring stands, this favorite Spanish sport has been presented for centuries.

The market, with its great variety of wares, from pottery to foodstuffs.

The jail and the city hall.

The Mission Nuestra Senora de Guadalupe, built in 1659, which is still in use today. The bells in the tower of the church were cast in Spain and transported to Juarez from the Gulf coast on mule back.

Then there are many cabarets and cafes in Juarez that cater to American trade. They are known from coast to coast. Two international bridges for street-car and motor traffic connect El Paso and Juarez.

The El Paso territory in West Texas, New Mexico and Arizona abounds in interesting places. Excellent highways lead from El Paso to all parts of the territory. One of the most interesting of these is the Carlsbad Caverns National Park near Carlsbad, N. Mex. The caverns in this park form one of the greatest natural wonders of the world, and are the largest known to man. Twenty-five to 30 miles of these subterranean passages have been explored. Seven miles of trails, electrically lighted, are open to the public. The formations of the caverns are greatly varied and are estimated at being millions of years old. In 1929, 80,000 visitors went through these caverns. It is a trip that all visitors to (*Continued on page* 689)

At top, golf course at Cloudcroft, the highest in the world. Center, the bull ring at Ciudad Juarez, Chihuahua, Mexico. Below, Twin Domes, Big Room, Carlsbad Cavern

El Paso, Tex., showing, in the foreground, the El Paso Smelting Works of the American Smelting and Refining Company and, across the Rio Grande River, the city of Juarez, Mexico

Annual WESTERN DIVISION Meeting at EL PASO, TEXAS

OF INTENSE interest to all American mining engineers will be the international atmosphere surrounding the annual meeting of the Western Division of the American Mining Congress, to be held at El Paso, Tex., October 13, 14 and 15. This convention in the border city is attracting a great deal of interest not only in the Southwest, but in Mexico as well.

Cooperating with the American Mining Congress in this meeting will be the American Institute of Mining and Metallurgical Engineers, the American Association of Petroleum Geologists, the West Texas Geological Society, the American Association of Engineers, the Arizona Chapter of the American Mining Congress, the El Paso Chamber of Commerce and the well-known society of Mexican engineers, the Centro Nacional de Ingenieros of Mexico City.

Mr. Brent N. Rickard, manager of the Southwestern Department of the American Smelting and Refining Company's plants at El Paso, Tex., and Hayden, Ariz., and chairman of the Board of Governors of the Western Division, is in charge of arrangements. Cooperating with him are the Mining Department of the El Paso Chamber of Commerce and many engineers residing in El Paso, who are prepared to make this convention an outstanding one, and one that will be long remembered.

A large delegation of engineers is expected from Mexico City and other parts of Mexico. Invitations have been extended to the governors of practically all of the states of Mexico, many of whom have already accepted, or are sending delegates.

To those engineers living in other parts of the United States this convention in El Paso offers a splendid opportunity to visit the many interesting mining camps of Arizona and the Southwest. A trip of only a few days' dura-

PARTICIPATING ORGANIZATIONS AND THEIR OFFICERS

THE AMERICAN MINING CONGRESS
President, Robert E. Talley, New York, N. Y.
Secretary, J. F. Callbreath, Washington, D. C.

WESTERN DIVISION
Governor, Brent N. Rickard, El Paso.

ARIZONA CHAPTER
Governor, T. H. O'Brien, Inspiration, Arizona.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS
President, W. H. Bassett, New York, N. Y.
Secretary, H. Foster Bain, New York, N. Y.

EL PASO SECTION
Chairman, David Cole, El Paso, Texas.

WEST TEXAS GEOLOGICAL SOCIETY
President, R. E. Rettger, San Angelo, Texas.
Chairman, Edgar Kraus, San Angelo, Texas.

CENTRO NACIONAL DE INGENIEROS
President, Sr. Ing. Francisco Cravioto, Mexico, D. F.
Chairman, Sr. Ing. Gustavo P. Serrano, El Paso, Texas.

AMERICAN ASSOCIATION OF ENGINEERS
President, H. A. Wagner, Chicago, Illinois.
Chairman, L. R. Fiock, El Paso, Texas.

EL PASO CHAMBER OF COMMERCE
President, Edgar W. Kayser, El Paso, Texas
Manager, E. H. Simons, El Paso, Texas.

MINING COMMITTEE
Chairman, Don. A. Carpenter, El Paso.

tion by automobile, or train, may be made from El Paso, taking in the interesting and progressive mining centers at Bisbee, Ray, Ajo, Jerome, Clifton and Morenci, in Arizona, and Silver City, in New Mexico.

The southwestern country is famous for its fine highways, affording easy automobile travel. Splendid air service from El Paso to all points in the United States and Mexico is available. Exceptionally good air service is now offered between El Paso and Mexico City, the journey being made between morning and evening.

The eighth annual convention of Mexican engineers, under the auspices of the Mexican government, is being held at Durango, Mexico, in the latter half of October, making it possible for mining engineers both in Mexico and the United States to attend, first, the convention at El Paso, and then the one in Mexico.

In addition to the opportunity thus offered to visit the mining districts of the Southwest and Mexico, this convention at El Paso also offers the opportunity to visit many of the interesting scenic spots of the Southwest, such as the Carlsbad Caverns National Park near Carlsbad, N. Mex., containing one of the greatest natural wonders of the world and the largest caves known to man. Then there are the delightful resorts at Ruidosa and Cloudcroft, N. Mex., and the historically interesting trips to Juarez, Mexico; Socorro, N. Mex., and to Santa Fe and other parts of New Mexico.

El Paso, itself, affords many interesting industrial sights, such as the new refinery of the Nichols Copper Company, the new refineries of the Pasotex Petroleum Company, a subsidiary of Standard Oil Company of California, the Texas Company's refinery, the Rio Grande Oil Company's refinery, the lead and copper plants of the El Paso Smelting Works of the American Smelting and Refining Company, the Southwestern Portland Cement Company and the modern power station recently built by the El Paso Electric Company, a subsidiary of Stone and Webster.

The convention will open on Monday, October 13, with headquarters at the Hotel Paso del Norte, under the auspices of the American Mining Congress. Topics for discussion at the opening session will be economic in nature and will refer to the mineral resources of the Southwest, international silver, taxing the mineral west. At noon a luncheon will be tendered the Board of Governors of the Western Division and other officers of the American Mining Congress. Delegates to the convention will be welcomed by Mayor R. E. Thomason, of El Paso, and a word of greeting will be extended by Mr. E. W. Kayser, president of the El Paso Chamber of Commerce.

Brent N. Rickard, Chairman, Board of Governors, Western Division, The American Mining Congress

The Western Division will take charge of the afternoon session, which will be devoted to operating problems in Arizona. Mr. T. H. O'Brien, governor of the Arizona Chapter and general manager of the Inspiration Consolidated Copper Company, will preside at this session.

Mr. A. C. Stoddard will present a paper on "Mining Methods at the Inspiration Consolidated Copper Company's Mine at Inspiration, Ariz." It is hoped that we may have a paper on "Long Hole Drilling as Practiced at the Ray Mines of the Nevada Consolidated Copper Company, Ray, Ariz." There will be a paper on the "History and Development of the Copper Queen Branch, Phelps Dodge Corporation," and a paper by Mr. I. J. Simcox, general superintendent of the Morenci Branch of the Phelps Dodge Corporation on "Fire Refining of Copper." This is a timely and interesting subject in view of the fact that both the Calumet and Arizona and Copper Queen Smelters, at Douglas, are now making anodes for shipment to the Nichols Copper Refinery at El Paso.

Following the adjournment sightseeing trips are planned for delegates, their wives and friends, to El Paso and vicinity. At 6 o'clock in the evening a barbecue and Spanish fiesta will be given in the Juarez Brewery Gardens, at Juarez, Mexico, to which will be invited all of the delegates, visitors, friends, wives and sweethearts. This will be an interesting occasion and will take place in a truly Mexican setting.

The sessions on Tuesday, October 14, will be under the auspices of the American Institute of Mining and Metallurgical Engineers. The morning session will be presided over by Mr. H. L. Carr, secretary of the El Paso section, and assistant general manager of the American Smelting and Refining Company's mining operations in Mexico.

Several interesting papers will be discussed including one on "Concentration of Oxidized Lead Ores at the San Diego Mill of the Santa Barbara Unit" of the Cia. Minera Ascarco, Santa Barbara, Chihuahua, Mexico, by Augustus J. Monks and Norman L. Weiss.

Another interesting paper will be on "Milling Practice at the San Francisco Mines of Mexico, Ltd.," by Mr. Glenn L. Allen. Mr. Howard Willey has prepared a paper on "Top Slicing With Filling of Slices," as used at the Charcas Unit of the Cia. Minera Asarco, at Charcas, San Luis Potosi, Mexico. Mr. John G. Barry, an eminent geologist of El Paso and the Southwest, in conjunction with a number of other engineers and geologists, is preparing an interesting paper on the "Geology of Ore Deposits in Northern Mexico."

Following the noon adjournment a luncheon will be given at the Hussman

Hotel in honor of the Mexican delegates and their friends.

The afternoon session will be presided over by Mr. E. P. Mathewson, of the Arizona Section of the American Institute of Mining and Metallurgical Engineers. At this session will be read papers on the "History and Development of Pyrometallurgy at the Copper Queen Smelter" by Mr. H. H. Stout; the "El Paso Refinery of the Nichols Copper Company" by Mr. C. W. Nichols; "Natural Gas Firing at the El Paso Smelting Works of the American Smelting and Refining Company" by Mr. E. R. Marble.

H. Foster Bain, Secretary, American Institute of Mining and Metallurgical Engineers

Two papers on mining will be discussed—"Recent Developments in Primary Crushing" by Mr. David Cole, whose knowledge of this subject is very broad indeed. There will also be an interesting paper on "Mine Methods and Costs at the Presidio Mine" by Van Dyne Howbert and Richard Bosustow.

At 7 o'clock in the evening there will be a dinner for the directors of the American Institute of Mining and Metallurgical Engineers, followed by a directors' meeting which is open to all members of the institute.

Wednesday, October 15, will be devoted to the West Texas Geological Society, American Association of Engineers, and the society of Mexican engineers known as the Centro Nacional de Ingenieros.

Mr. Edgar Kraus, of the Atlantic Refining Company and representing the West Texas Geological Society and the American Association of Petroleum Geologists, will preside at this session. An address will be made by Dr. Bybee on the "General Geologic Features of West Texas and New Mexico." This will be followed by a paper by Mr. E. L. Porch, Jr., on the "Sulphur Deposits in West Texas and New Mexico," after which Mr. Paul Weaver will make an address on the subject of "Potash Deposits in West Texas and New Mexico."

Robert E. Tally, President, The American Mining Congress

T. H. O'Brien, Governor, Arizona Chapter, The American Mining Congress

William H. Bassett, President, American Institute of Mining and Metallurgical Engineers

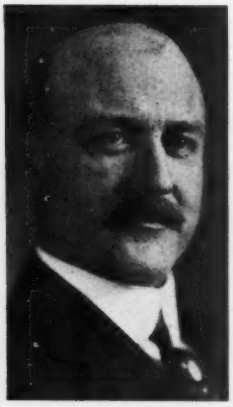
Under the auspices of the American Association of Engineers, El Paso Chapter, Mr. L. R. Fiock, president of the El Paso Chapter, presiding, Dr. G. M. Butler, dean of the University of Arizona, at Tucson, Ariz., will make an address on the "Aims and Objects of the American Association of Engineers."

The session of the Centro Nacional de Ingenieros will be presided over by Sr. Ing. Gustavo P. Serrano, commissioner for Mexico of the United States and Mexico Boundary Survey (Comision Mexicana de Limites). Papers on engineering problems in Mexico will be read at this session and it is expected that the session will be conducted in Spanish for the benefit of our Spanish-speaking engineers from Mexico and the United States.

A luncheon will be given in honor of the West Texas Geological Society at the El Paso Club, Hussman Hotel.

The American Mining Congress will again take

University of Texas College of Mines and Metallurgy, located at El Paso



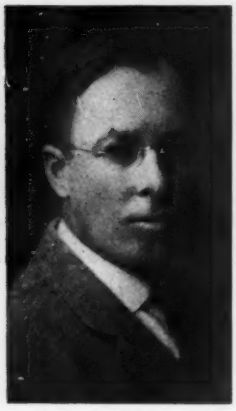
A. G. Mackenzie

Frank M. Smith

R. M. Betts

Maurice D. Leehey

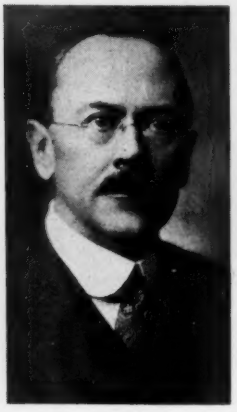
Bruce C. Yates



R. G. Wayland

G. Chester Brown

C. L. Berrien



William Daly

Wm. B. Gohring

charge of the meeting on Wednesday afternoon, October 15, with Mr. John M. Sully, general manager of the Chino Mines of the Nevada Consolidated Copper Company, presiding. At this meeting operating problems in New Mexico will be discussed. This will include papers on "Recent Developments in Milling Practice" at the New Mexico Division, Chino Mines; a paper by Mr. L. M. Kniffin on the "Magnetic Cobbing Plant of the Hanover-Bessemer Iron and Copper Company."

Mr. J. T. Matson will give a paper on the "Construction and Operation of the Twelve-Mile Aerial Tramway" of the American Metals Company, at Pecos, N. Mex., and Mr. I. J. Stauber will give a short address on his interesting deposit of copper in the red beds at Pastura, N. Mex. Mr. Ira L. Wright, manager of the Blackhawk Consolidated Mill at Silver City, N. Mex., will give a short address on "Cost Accounting and Milling Operations."

These papers will be followed by the report of the Committee on Resolutions.

The annual banquet and ball will be given at 7 o'clock in the banquet hall of the Paso del Norte Hotel. Many interesting features are planned for this banquet, and a few short addresses will be made by men prominent in the engineering field in the United States and Mexico.

The entertainment committee has an interesting schedule of entertainments following the noon and afternoon sessions for each day of the convention. It is hoped that many members of the institute will bring their wives, daughters, sisters and sweethearts to El Paso. The women of El Paso are making arrangements to entertain the visiting ladies in such a way that every minute of their time will be pleasantly occupied.

El Paso and Juarez offer many features for entertainment. El Paso has a beautiful golf course at the El Paso Country Club and it is hoped that many of the delegates, as well as their wives, will be able to enjoy a game of golf while in El Paso. The ladies in particular are asking that visiting ladies bring their golf clubs so that a tournament may be arranged.

Post-Convention Side Trips

The committee on excursions will be very glad to arrange interesting side trips, some of which are as follows:

Excursion into interior of Mexico. This will include the Boquillas Dam and Power Plant via Chihuahua. At Chihuahua may be visited the smelter of the American Smelting and Refining Company and the famous mines and mills at Santa Eulalia. The trip will occupy two or three days and the cost would be $25 to $50. This trip may be made by airplane in one day.

A trip to the Carlsbad Caverns can be made in one day by airplane, or automobile. The cost would be from $30 to $50.

A trip to Elephant Butte Dam can be made by automobile, or airplane, at a cost of about $25. One or two days should be devoted to this trip in order to enjoy the excellent fishing.

The mountain resorts of Cloudcroft and Ruidosa can be visited in two days' time at a cost of $25 to $50.

Other trips by airplane into Arizona and Mexico can be readily arranged.

Hotel reservations may be made through Mr. Brent N. Rickard, El Paso Smelting Works, P. O. Box 1111, El Paso, Tex., or may be addressed directly to the hotels of El Paso, which are as follows:

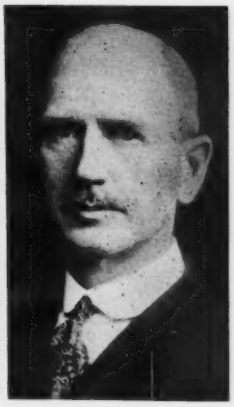
Hotel Paso del Norte, (convention headquarters)—Hotel Hussman. These

John M. Sully

Ravenel Macbeth

J. F. Woodbury

Philip Wiseman



Jesse F. McDonald

Leon Starmont

J. C. Kinnear

C. Lorimer Colburn

Axel P. Ramstedt

Members of the Board of Governors of the Western Division of The American Mining Congress on this and the foregoing page

are the two large hotels of the city. Among the smaller hotels are listed—the Gateway, McCoy, St. Regis, Lockie, Knox, Gardner and Campbell. The new 20-story Hilton Hotel on the site of the old Sheldon Hotel is under construction, but probably will not be completed in time for the convention.

EL PASO, TEXAS

(*From page 684*)

the Southwest should make.

North from El Paso in New Mexico is the Lincoln National Forest. Included in this area is Cloudcroft, mountain summer resort at an elevation of 9,000 ft. Here is the highest golf course in the world. Hundreds of summer cabins are to be found here among the giant pines that cover the crests of the Sacramento Mountains. Farther to the north is the Mescalero Apache Indian Reservation and the Ruidoso summer resort section. It was here that Billy the Kid, notorious, and fast becoming legendary, bandit held forth.

At the foot of these mountains lies Alamogordo, N. Mex. In the basin west of Alamogordo are the White Sands, a gigantic deposit of pure gypsum covering 270 square miles in great dunes of dazzling whiteness.

Beyond the sands are the Organ and San Andreas mountain ranges. Crossing the mountains through St. Augustine Pass, the traveler is struck by the wild beauty and grandeur of the rugged mountain scenery. On the other side one is in the Rio Grande Valley again, and soon arrives at Las Cruces. North from this little New Mexican city at Hot Springs is the Elephant Butte Dam, forming the largest artificial lake in the world. Here may be found excellent bass and trout fishing.

Beyond Silver City in the Mogollon County is another excellent hunting and fishing country. Here the wilderness is almost as it was a 100 years ago. The best game country is reached only by pack train.

Turning back toward El Paso and south of Las Cruces are old volcanic craters. It is in this section that some of the most important archeological finds of the Southwest have been made.

The visitor to El Paso who wishes to spend a splendid vacation may make many trips ranging from one day to two weeks out of El Paso, in which he will see lands ranging from desert to rich irrigated valleys and pine-clad mountains.

GOLD BOUNTY PROPOSED IN AUSTRALIA

A new movement is being organized in Australia to induce the Federal Government to pay a bounty of £1 an ounce on all standard gold produced over a fixed period of 10 years, according to reports to the Commerce Department. Western Australia and Victoria are, naturally, the two states furthering this movement. (In 1929 Australian gold was valued at £1,807,411, of which £1,602,142 was for gold produced in Western Australia.) There has been a steady decline in production from 943,653 fine ounces produced in 1920 to 508,303 in 1927; there are no complete statistics for later years but the decline has continued.

Many of the Australian gold mines have been worked out, especially in the eastern states, but it is claimed that western Australia has considerable deposits of low-grade ore which are not worked now because of the high cost of production. At one time it would not have mattered what the cost of production was. In a recent discussion in the Senate it was stated that the mining industry has to pay greatly increased costs for mining machinery and other articles necessary to recover a product which has remained at the old price. The question of the bounty is still under consideration.

TENTATIVE PROGRAM

JOINT MEETING

WESTERN DIVISION—THE AMERICAN MINING CONGRESS

and the

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS

IN COOPERATION WITH

American Association of Petroleum Geologists
West Texas Geological Society
Centro Nacional de Ingenieros

American Association of Engineers
Arizona Chapter, The American Mining Congress
El Paso Chamber of Commerce

EL PASO, TEX., OCTOBER 13-14-15, 1930

The American Mining Congress

(WESTERN DIVISION, ANNUAL MEETING)

MONDAY, OCTOBER 13, 1930

Paso Del Norte Hotel

MORNING SESSION

9.00 A. M.

Registration in Lobby.

9.30 A. M.

Morning Session, Banquet Hall.
BRENT N. RICKARD, *Governor, Western Division, presiding.*

ADDRESS OF WELCOME, *by Mayor R. E. Thomason, of El Paso.*

ADDRESS OF WELCOME, *by Edgar W. Kayser, President, El Paso Chamber of Commerce.*

ADDRESSES

"MINERAL RESOURCES OF THE SOUTHWEST," *by*
"INTERNATIONAL SILVER," *by*
"TAXING THE MINERAL WEST," *by*

12 NOON

ADJOURNMENT

LUNCHEON—Board of Governors, Western Division of The American Mining Congress (El Paso Club, 10th Floor, Hussman Hotel).

AFTERNOON SESSION

2.00 P. M.

Introduction of Resolutions.

OPERATING PROBLEMS IN ARIZONA

Chairman, T. H. O'BRIEN, Governor Arizona Chapter, The American Mining Congress.

ADDRESSES

"MINING METHODS AT INSPIRATION CONSOLIDATED COPPER COMPANY MINE, INSPIRATION, ARIZ.," *by A. C. Stoddard.*

"LONG HOLE DRILLING AS PRACTICED AT THE RAY MINES OF THE NEVADA CONSOLIDATED COPPER COMPANY, RAY, ARIZ.," *by*

"HISTORY AND DEVELOPMENT OF THE COPPER QUEEN BRANCH, PHELPS DODGE CORPORATION," *by*

"FIRE REFINING OF COPPER," *by I. J. Simcox, General Superintendent, Morenci Branch, Phelps Dodge Corporation.*

ADJOURNMENT

Sight-seeing trips, El Paso and vicinity.

6.00 P. M.

Barbecue and Spanish Festival, Juarez Brewery Gardens, Juarez, Mexico.

The American Institute of Mining and Metallurgical Engineers

TUESDAY, OCTOBER 14, 1930

Paso Del Norte Hotel

MORNING SESSION

9.00 A. M.

Registration of Delegates.

9.30 A. M.

Morning Session.
Chairman, H. L. CARR, Secretary El Paso Section, American Institute of Mining and Metallurgical Engineers.

ADDRESSES

"CONCENTRATION OXIDIZED LEAD ORES AT SAN DIEGO MILL OF THE SANTA BARBARA UNIT," *Cia. Minera Asarco, Santa Barbara, Chihuahua, Mexico, by Augustus J. Monks and Norman L. Weiss.*

"MILLING PRACTICE AT THE SAN FRANCISCO MINES OF MEXICO, LTD.," *San Francisco del Oro, Chihuahua, Mexico, by Glenn L. Allen.*

"TOP SLICING WITH FILLING OF SLICES," *as used at the Charcas Unit of the Cia. Minera Asarco, Charcas, San Luis Potosi, Mexico, by Howard Willey.*

"GEOLOGY OF ORE DEPOSITS IN NORTHERN MEXICO," *by J. G. Barry and others.*

ADJOURNMENT

12.30 P. M.

Luncheon in honor of Mexican delegates, Hussman Hotel, Crystal Ball Room. Ladies at Country Club.

2.00 P. M.

Afternoon Session.
Chairman, E. P. MATHEWSON, of the Arizona Section, American Institute of Mining and Metallurgical Engineers.

ADDRESSES

"HISTORY AND DEVELOPMENNT OF PYROMETALLURGY AT THE COPPER QUEEN SMELTER," *by H. H. Stout.*

"THE EL PASO REFINERY OF THE NICHOLAS COPPER CO.," *by C. W. Nichols.*

"NATURAL GAS FIRING AT THE EL PASO SMELTING WORKS" *of the American Smelting and Refining Co., by E. R. Marble.*

"RECENT DEVELOPMENTS IN PRIMARY CRUSHING," *by David Cole.*

"MINE METHODS AND COSTS AT THE PRESIDIO MINE," *by VanDyne Howbert and Richard Bosustow.*

ADJOURNMENT

Sight-seeing trips, El Paso and vicinity.

7.00 P. M.

American Institute of Mining and Metallurgical Engineers Directors' Dinner, Hotel Paso Del Norte, Unique Dining Room.

Cooperating Organizations

West Texas Geological Society, San Angelo, Texas
American Association Petroleum Geologists
American Association of Engineers, El Paso Chapter
Centro Nacional de Ingenieros of Mexico, D. F.

WEDNESDAY MORNING, OCTOBER 15, 1930

Paso Del Norte Hotel

MORNING SESSION: WEST TEXAS GEOLOGICAL SOCIETY

9.00 A. M.

Registration of Delegates.

9.30 A. M.

Chairman, EDGAR KRAUS, *of the West Texas Geological Society and American Association of Petroleum Geologists.*

ADDRESSES

"GENERAL GEOLOGIC FEATURES OF WEST TEXAS AND NEW MEXICO," *by Dr. Bybee.*

"SULPHUR DEPOSITS IN WEST TEXAS AND NEW MEXICO," *by E. L. Porch, Jr.*

"POTASH DEPOSITS IN WEST TEXAS AND NEW MEXICO," *by Paul Weaver.*

AMERICAN ASSOCIATION OF ENGINEERS—EL PASO CHAPTER, *Chairman, L. R. Fiock, President El Paso Chapter, American Association of Engineers, presiding.*

"AIMS AND OBJECTS OF THE AMERICAN ASSOCIATION OF ENGINEERS," *by Dr. G. M. Butler, Dean, University of Arizona, Tucson, Ariz.*

CENTRO NACIONAL DE INGENIEROS, *Chairman, Sr. Ing. Gustavo P. Serrano, Commissioner for Mexico of the United States and Mexico Boundary Survey (Comision Mexicana de Limites), presiding.*
Addresses on Engineering Problems in Mexico (to be selected).

ADJOURNMENT

12.30 P. M.

Luncheon in honor of West Texas Geological Society delegates and friends, El Paso Club, Hussman Hotel.

The American Mining Congress

(WESTERN DIVISION, ANNUAL MEETING)

WEDNESDAY, OCTOBER 15, 1930

Paso Del Norte Hotel

AFTERNOON SESSION

2.00 P. M.

Chairman J. M. SULLY, *Governor of the New Mexico Chapter of The American Mining Congress.*

ADDRESSES

"RECENT DEVELOPMENTS IN MILLING PRACTICE," *at New Mexico Division, Chino Mines, Nevada Consolidated Copper Co., Hurley, N. Mex., by*

"MAGNETIC COBBING PLANT" *of Hanover-Bessemer Iron and Copper Co., Hanover, N. Mex., by L. M. Kniffin.*

"CONSTRUCTION AND OPERATION OF THE TWELVE MILE AERIAL TRAMWAY," *of the American Metals Company, at Pecos, N. Mex., by*

"GEOLOGY OF ORE DEPOSIT AND MINING METHODS OF THE I. J. STAUBER OPERATION AT PASTURA, N. MEX.," *by I. J. Stauber.*

"COST ACCOUNTING IN MILLING OPERATIONS AT THE BLACKHAWK CONSOLIDATED MILL AT SILVER CITY, N. MEX.," *by Ira L. Wright.*

Report of Committee on Resolutions.

4.30 P. M.

ADJOURNMENT

7.00 P. M.

Annual Banquet and Ball, Banquet Hall, Paso Del Norte Hotel.

Excursions

THURSDAY, OCTOBER 16, 1930

EXCURSION TO CARLSBAD CAVERNS

Those wishing to make this trip, which can be made in one day, will please make arrangements with those in charge of registration of delegates.

Trips will also be made to various points of interest around El Paso, including the following:

Nichols Copper Company Refinery.
Pasotex Petroleum Company Refinery.
Texas Company Refinery.
Rio Grande Oil Company Refinery.
El Paso Smelting Works.
Southwestern Portland Cement Company.

Rio Grande Station of El Paso Electric Company's Power Plant.

Other trips in El Paso and Juarez will be arranged to suit the convenience and desires of members and delegates.

Arrangements will be made for those desiring to take a trip to visit the Chino Mines of the Nevada Consolidated Copper Co., and other points of interest at Silver City, N. Mex.

The Eighth Annual Convention of Mexican Engineers will be held at Durango, Mexico, in the latter half of October. Arrangements for those desiring to attend this convention, and to make the trip to Chihuahua City, Durango and other points of interest in Mexico, may be made through the Committee on Excursions.

Committees

CONVENTION HEADQUARTERS,
HOTEL PASO DEL NORTE

GENERAL COMMITTEE ON ARRANGEMENTS

BRENT N. RICKARD, *Chairman.*
MALCOLM H. CARPENTER, *Accommodations and Transportation.*
EARL R. MARBLE, *Technical Program and Meetings.*
HOWARD H. FIELDS, *Entertainment.*
FRANK J. GANNON, *Finance.*
GERALD F. PERRY, *Press and Publicity.*
MRS. JOHN G. BARRY, *Ladies' Entertainment.*
L. M. LAWSON, *International Relations.*
GUSTAVO P. SERRANO, *Mexican Engineers' Participation.*
FREDERICK M. SHAW, *Mining and Metallurgical Industries' Participation.*
WALTER G. HAMILTON, *Petroleum Industries' Participation.*
H. G. FROST, *Natural Gas Industries' Participation.*
W. R. BLAIR, *Cement and Crushed Rock Industries' Participation.*
GEORGE B. RYAN, *Mining Supply Companies' Participation.*
JOHN W. KIDD, *College Students' Participation.*

TECHNICAL PROGRAM AND MEETINGS

EARL R. MARBLE, *Chairman*

John G. Barry, James E. Bell, H. L. Carr, David Cole, W. S. Harrison, Robert McCart, H. R. MacMichael, L. Plass.

ACCOMMODATIONS AND TRANSPORTATION

MALCOLM H. CARPENTER, *Chairman.*
JOHN R. DALBY, *Vice Chairman in Charge Hotels and Registrations.*
CHARLES F. THOMPSON, *Vice Chairman in Charge Transportation and Excursions.*

HOTELS AND REGISTRATIONS

Don Carpenter, T. A. Courchesne, LeRoy G. Hetrick, E. Norris Hobart, Manuel F. Mora, E. E. Miller, Robert S. Reading, Warren Small.

TRANSPORTATION AND EXCURSIONS

Homer E. Anderson, John P. Dyer, Chas. E. Graham, H. E. Nichols, Ben N. Norton, Herbert Wolcott, Robert C. Stryker.

ENTERTAINMENT

HOWARD H. FIELDS, *Chairman*

Harold Boedtker, R. H. Carrington, J. W. Crowdus, John S. Curtiss, A. L. Eaton, Frank Fletcher, Paul Harvey, L. R. Hoard, E. Norris Hobart, Frank Knotts, Marden H. Hayward, Alfonso Martinez, E. E. Neff, Manuel B. Otero, Armando Santa Cruz, W. P. Schumacher, S. E. Stretton, Chas. Stott, Frank Thomas.

FINANCE

FRANK J. GANNON, *Chairman*

W. R. Blair, J. D. Foster, George B. Ryan, H. A. White.

PRESS AND PUBLICITY

GERALD F. PERRY, *Chairman*

M. Boretz, H. W. Hailey, H. S. Hunter, B. W. Lewis, W. J. Moran, Wallace Perry, Dorrance Roderick.

GOLD PRODUCTION

(*From page* 683)

mines, be they even another Lena Goldfields (500,000 ozs. per annum), a second Hollinger (450,000 ozs. per annum), or Homestake (300,000 ozs. per annum), would not appreciably alter the picture of the future outlook for world gold production which is controlled by the output of the Rand.

The following figures show ore reserves and grade of leading gold lode mines outside the Rand:

Hollinger (Dec. 31, 1927)...	5,789,438 tons	$ 9.89
McIntyre (Dec., 1928).....	1,546,754 tons	8.45
Morro Velho (Jan., 1929)..	1,171,537 tons	14.58
Ashanti Goldfields Corp., West Africa (Sept. 30, 1929)	590,200 tons	25.20
Cam & Motor, Rhodesia (June 30, 1929).....	1,260,500 tons	12.70
Mysore Gold (India) 1928..	569,617 tons	10.00
Chosen, Korea (June, 1929)	200,000 tons	7.57

New Discoveries

The discovery of new large goldfields becomes less likely with every year. Gold has been coveted by mankind for thousands of years and is more easily found in nature than other metals. It occurs mainly associated with quartz or silicified rocks which withstand erosion more readily than enclosing formations. Gold deposits, therefore, so far as they have not been eroded are apt to outcrop on the surface. In places where they do not outcrop, quartz float is usually found, being more permanent than other rock debris. Gold, because of its chemical and physical qualities is nearly indestructible and traces of it in river sands, gravels and soil will lead the prospector to its source. If the original vein has been eroded, the gold contents, because of their specific gravity, will tend to concentrate in stream or river beds and form the so-called placer deposits.

The chances of discovering new gold deposits by means of geophysical prospecting are not promising. These methods are based upon differences in electrical conductivity or specific gravity. Therefore, it is readily apparent that they are much more applicable to bodies of massive sulphides than to quartz deposits containing quantitatively insignificant amounts of gold or base metal sulphides.

The world has undoubtedly been more thoroughly prospected for gold than for any other metal. Even in ancient Egyptian times mining for gold extended through Northern Africa probably farther south than Abyssinia, as well as in the Arabian Peninsula. It has been the principal object of search by adventurous prospectors throughout the ages, especially in placer form, because—

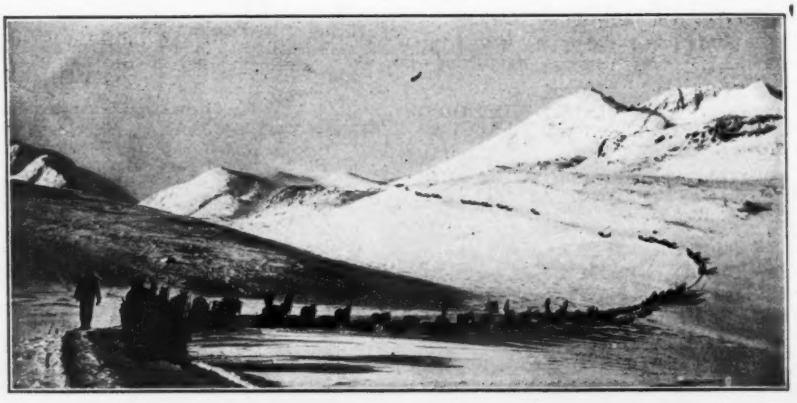
(a) Placer gold is easily traced through panning along streams;

(b) Placer deposits are easily worked by the individual, without the necessity of much machinery other than shovels, picks and roughly made sluice boxes;

(c) The results are readily concentrated into a small bulk and so made portable for long distances by man or beast in countries without roads.

The placer fields of California were discovered and worked when that country was little known otherwise, as were also the placers of Montana. The placers of the frozen North (the Klondike and Nome Districts), of Siberia with an equally frigid climate, as well as those in the hot desert areas of Australia—all indicate the intensity and success with which placer deposits of gold have been sought and worked in the most inaccessible and climatically unfavorable portions of the world. While large placer deposits may conceivably remain, after mankind's search for thousands of years and especially after the intensive exploration of recent generations, the probability is that very few spots of the earth are left which have not been carefully explored and investigated. As above stated, gold mines other than placer are found in quartz, which, being harder than most rock substances, has made it possible to find quartz deposits because of their prominence in the surrounding country.

The Rand itself was discovered in 1885 and one has only to recall the surrounding conditions of savage tribes and trackless wastes in that country at that time to realize the difficult conditions under which gold is discovered, so strong has been the lure in its search. Since the War. Africa has been intensively prospected. The aeroplane has played its part there, as in Canada and elsewhere, in establishing distant bases from which prospecting takes place in otherwise inaccessible portions of the world. With the possible exception of desert areas in Australia, Central Asia and around the Sudan, and those tropical areas at the head waters of the Amazon and Orinoco Rivers, which so far have been almost inaccessible because of the hostility of the native tribes and the nature of the climate, there are few portions of the earth's surface which have not been subjected to man's eager search for gold. When one reflects upon the long duration and intensive character of this search, one may quite properly conclude that the chances of discovery of new gold mines of magnitude are very much less than is generally supposed, even by economists and other students who are apt to conclude that because the last century has seen the discovery of one gold field after another (California, Australia, the Rand, Klondike, Lena, etc.), the process can and will go on indefinitely. The mining engineer knows that such is not the case, although it is still possible, even if not probable, that some important discovery may yet be made.



Summary

Summarizing the above, it would appear that world gold production will remain stable at around 20,000,000 ozs. during the next few years until not later than 1935, when a slow decrease will probably begin, bringing world production down to about 15,000,000 ozs. by 1940.

Notwithstanding the fact that more than half of the world's gold production has been coined in recent years, it is generally estimated that not more than about half the world's annual production is available for currency and banking purposes, since gold disappears through hoarding and through consumption in the arts.

No reduction of consumption, for industrial purposes is to be anticipated. In fact, changes in fashions for jewelry, expanding needs for the arts, etc., are likely to increase this demand. And as this demand will be supplied first, it follows that any reduction in world production will reduce, not proportionately, but equally, the new gold available for banking and currency purposes. It seems logical to expect that between 1935 and 1940 the available gold supply for the latter purpose will not exceed 5,000,000 to 6,000,000 ozs. per annum, *i. e.*, about half of what it is at present.

METALS

GUY N. BJORGE
Editor

Practical Operating Problems of the Metal Mining Industry

Mining Methods and Costs at the Engels Mine

By **W. I. Nelson**†

THE Engels Copper Mining Co. operates two mines about three miles apart in Plumas County, Calif. Both mines send ore to the same mill, and the methods of the larger, or Engels mine, are described in this paper. Between 800 and 1,000 tons of 1¾ to 2½ percent copper ore are mined daily from this mine by a shrinkage method.

Connection is made with the Western Pacific Railroad at Paxton by the Indian Valley Railroad, which is 22 miles long and operates a daily mixed train to the mine.

The author is indebted to Mr. O. H. Bru, treasurer of the Engels Copper Mining Co., for the early history of the mine. Some information has been taken from articles by Mr. W. R. Lindsay, former superintendent, and by the author.‡

History

Copper ore was discovered in the Plumas County district in 1865. A small smelter ran intermittently for four years and was then abandoned as a losing investment.

The Engels mine was located in the late seventies by Henry Engels, and he and his two sons devoted their entire time to the development of the property. The nearest railroad connection at that time was at Reno, Nev., which could be reached over 150 miles of mountain road. Persistent work uncovered considerable ore, some of the richest of which was hauled to Reno and shipped to Swansea, Wales, by way of San Francisco.

In 1901 the Engels Copper Mining Co. was organized. It was not until the reorganization of the company in 1914, however, that operations commenced on a substantially larger scale. At this time a mill with a daily capacity of 150 tons was built and shipments of concentrate were made in addition to those of ore. The concentrate and ore were transported to the bottom of a 1,000-ft. hill by an aerial tram and thence by truck to the Western Pacific Railroad at Keddie, 28 miles away. During the dry season three trucks averaged two round trips and transported 20 tons every 24 hours. Transportation difficulties during the winter months led to the construction of the Indian Valley Railroad, which was completed early in 1917. In order to further increase tonnage, the Superior mill, having a crusher capacity of 1,500 tons per day, and a 2-mile aerial tram from No. 6 level were built and completed in the early part of 1918. In 1924 the electric haulage system through No. 10 adit was put in operation and the aerial tram discarded. Since this time the production from the Engels mine has been gradually increased from 800 to 1,000 tons per day. The total production of the mine to date has been 335,870 tons of ore.

The ore in the Engels mine occurs in shear zones in diorite and altered diorite. The ore bodies vary in length; they have a general strike of N. 60 E. and a dip of 80° to the west. The main ore body consists of three shear zones, two of which are nearly parallel; the third separates from the other two by raking more strongly toward the north. Two other lodes containing commercial ore occur, in one of which the ore is in the form of lenses.

The principal copper minerals are bornite and chalcopyrite, with some secondary chalcocite occurring in the upper levels. The mineralizing solutions evidently followed the channels made by the shearing in the altered diorite; the minerals occur as interlacing networks of small veins in some places and as bunches of ore and disseminations through the rock in other places. The grade of the ore is dependent upon the intensity and the width of the shearing which allowed the mineralizing solutions to permeate through the rock. The proportion of bornite to chalcopyrite is about 2 to 3, and this ratio remains fairly constant with depth; if any change occurs it appears to be an increase in bornite. Above the fourth level much of the ore mined assayed 4 percent copper, probably due to chalcocite enrichment. Below the fourth level the ore has averaged from 1¾ to 2½ percent copper.

The main ore body had a maximum width of 100 ft. and a length of 830 ft. Croppings of carbonates were evidently prominent over the main ore body. The surface rock over the other ore zones,

* Reprinted from U. S. Bureau of Mines Information Circular 6260.

† One of the consulting engineers, U. S. Bureau of Mines.

‡ Lindsay, W. R., Construction of Ore Transfer Raise of Engels Copper Mining Co., *Eng. and Min. Jour.*, Aug. 8, 1925; also Electric Blasting in the Engels Mine, *Eng. and Min. Jour.*, Oct. 10, 1925. Nelson, W. I., Removing Vertical Pillars by Diamond Drill Methods, *Eng. and Min. Jour.*, April 20, 1929. Nelson, W. I., The Application of Multiple Graded Series in Parallel Connections at the Engels Mine, *The Explosives Engineer*, May, 1929.

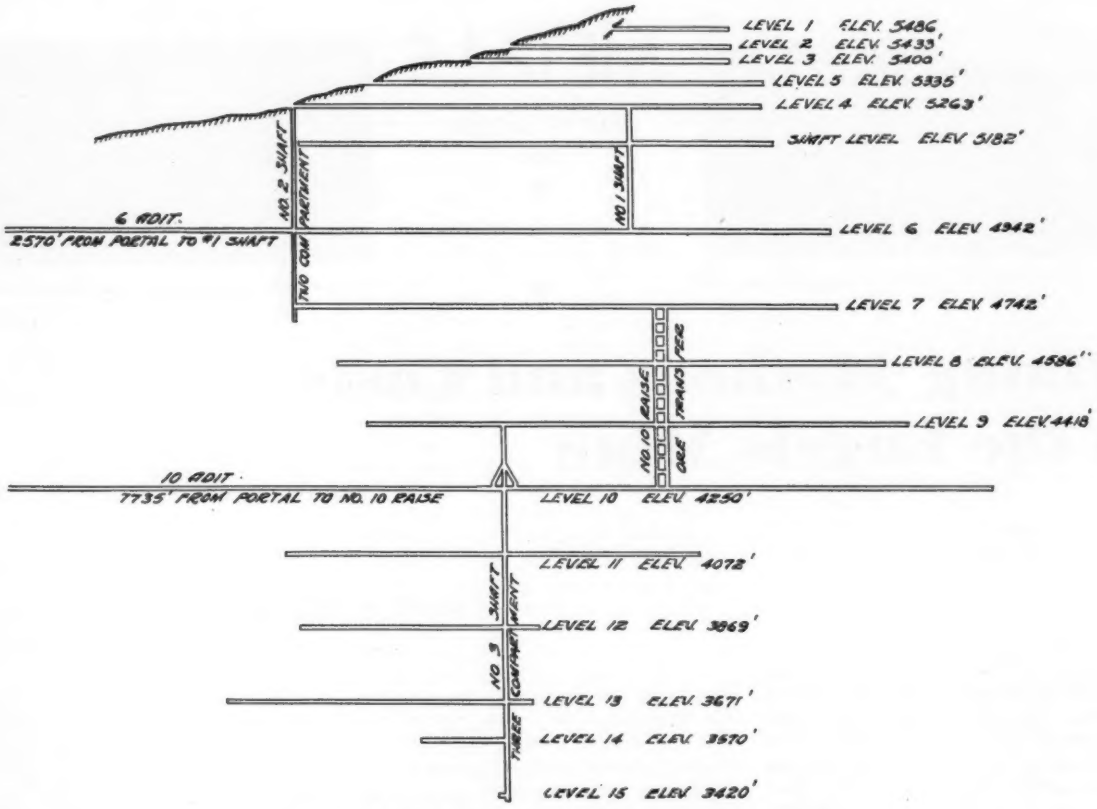


FIGURE 1.-DEVELOPMENT OF ENGEL MINE

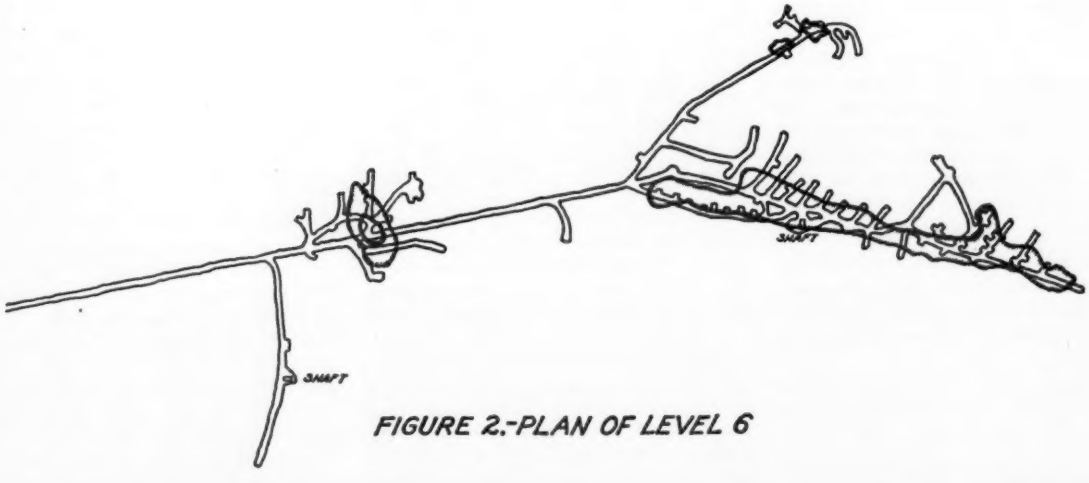


FIGURE 2.-PLAN OF LEVEL 6

however, was disintegrated and leached to such an extent that very little carbonate was present.

The diorite and altered diorite are very firm, tough rocks which stand well in unsupported walls. There are systems of both vertical and nearly flat cleavage planes and slips which rarely interfere but usually help in the shrinkage stope method. The ground does not require timber for support except occasionally where faults cross a drift.

Methods of Prospecting and Exploration

The shear zones are usually persistent but sometimes they vary slightly in their downward course. When a level is opened up, drifts are run to the pro-

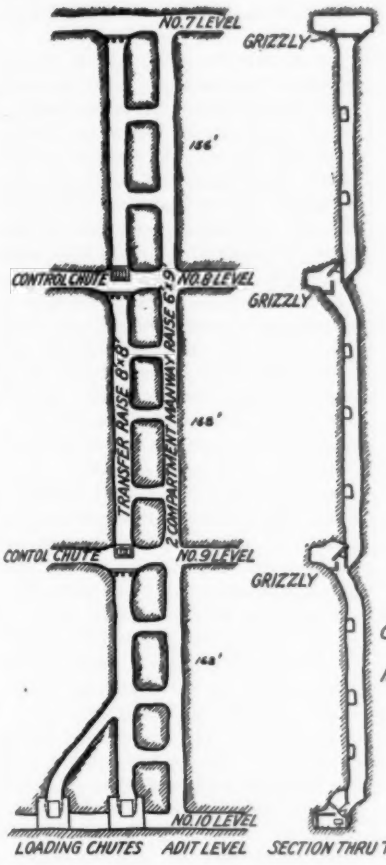


FIGURE 3.
ORE TRANSFER
AND
MANWAY RAISE

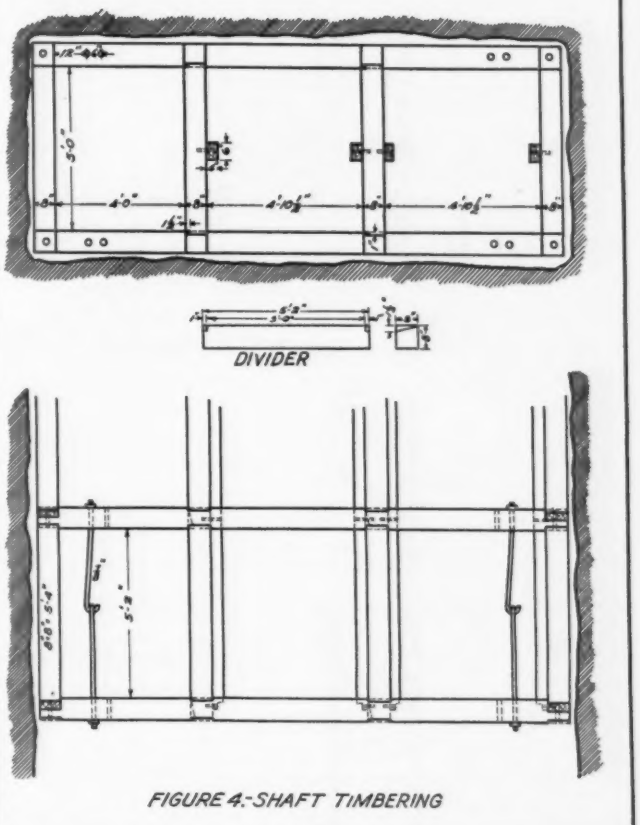


FIGURE 4.-SHAFT TIMBERING

jected position of the ore body and either strike the ore zone or are so near to it that only short crosscuts are required. The occurrence of barren sections in the shear zones has necessitated the use of the diamond drill for exploratory work. The diamond drill has also been employed to prospect for other ore zones and to determine the grade and location of the known ore zones at depth. The holes are put in on contract and are drilled at a base price of $2.45 per foot for holes inclined less than 15° from the horizontal and less than 400 ft. long. An increase of 15 cents per foot is made for each 100 ft. over the first 400 ft. Holes run at an angle steeper than 15° have a base rate of $2.70 per foot for the first 400 ft. and increase 15 cents per foot for each 100 ft. thereafter. Up to the present time a total of 75,378 ft. of prospect holes has been drilled.

Electrical prospecting was carried on over a considerable portion of the surface near the Engels mine, but this work did not indicate any ore bodies. On account of the occurrence of magnetite with the ore a magnetic survey was also made on the surface, and the results showed weak mineralization at several places. The indicated mineralized areas, however, did not develop into commercial ore bodies.

Methods of Sampling and Estimation of Tonnages and Values

In development work a pick sample is taken from the face and also a grab sample from the broken rock after each round is blasted.

In stoping, the drill cuttings from two or three holes each day are caught in a powder box and sent to the assay office. The assay result furnishes a guide to the values in the rock being broken. A small grab sample is taken from each car when drawing ore from the chutes; this serves as a check on the grade of the ore from the stopes. The car samples usually run higher than the mill head.

The amount of ore broken is calculated by means of monthly transit surveys of the stopes and of the development workings. The tonnage of ore crushed is determined by a weightometer at the mill. Twelve cubic feet in place is taken as one ton of ore, and 18 cubic feet as the tonnage factor for broken ore.

The amount of ore in reserve is calculated from the height and from the average cross section and assay of the area stoped above and below each block. No systematic sampling of ore reserves is done.

Methods of Development and Mining

General Development

The ore bodies have been developed by means of adits and vertical shafts as shown in *Figure* 1. The following historical sketch illustrates the general method of development of the mine.

In the upper portion of the mine four adits were successively driven into and along the ore bodies at various elevations. Crosscuts were run and shrinkage stopes started as soon as the development work permitted. The fourth level was driven about 300 ft. below the highest cropping of ore. On this level a winze was sunk in the ore, and the so-called shaft level was started 100 ft. below. The ore from development and stoping operations was hoisted to the fourth level and trammed to the Engels mill. The sixth-level adit, 2,570 ft. long, was driven 250 ft. below the shaft level. Raises were run from this level to the shaft level for ventilation, and stoping was started. All of the sixth level ore was transported through No. 6 adit and over an aerial tram to the

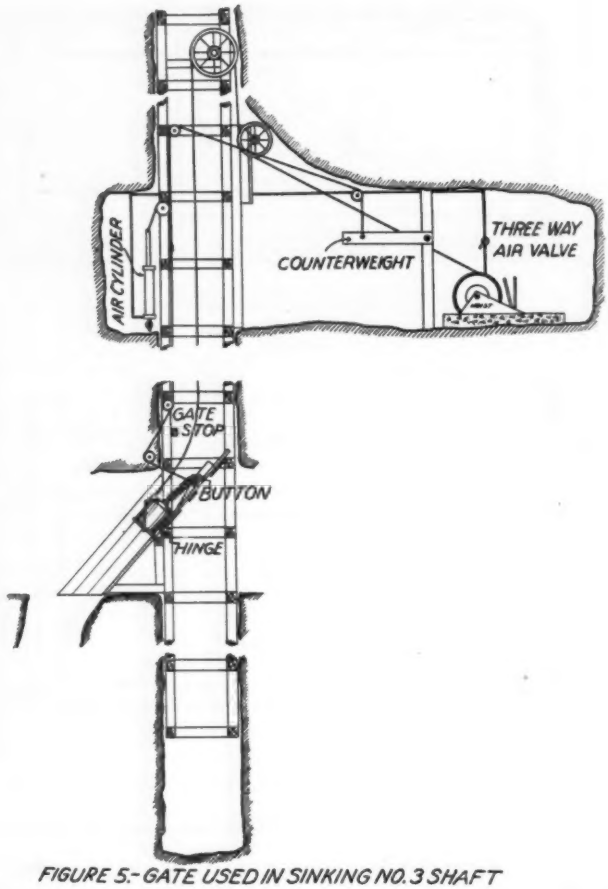


FIGURE 5.- GATE USED IN SINKING NO. 3 SHAFT

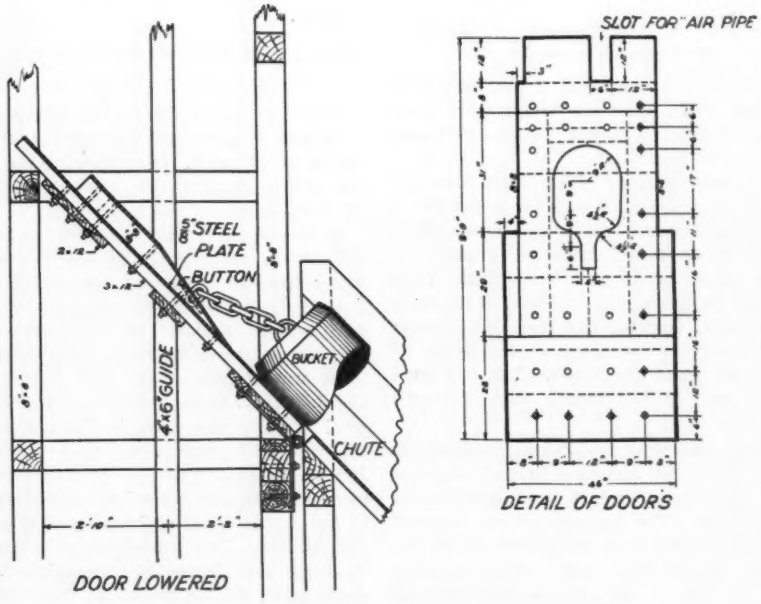


FIGURE 6.- DOOR USED IN SINKING NO. 3 SHAFT

Superior mill. *Figure* 2 is a plan of the sixth level, which is a typical haulage level.

No pillars had been left in any of the stopes above the shaft level, and stoping was started according to the same plan on the sixth level. Access to the stopes was by means of cribbed manways. After the stopes had reached a height of about 100 ft. these manways caused trouble by leaning over, due to the uneven withdrawal of ore. In addition, the walls of the stope had a tendency to cave when the broken ore was withdrawn upon completion of back stoping. To overcome these difficulties, pillars 20 ft. wide were left from foot to hanging wall at intervals of 90 to 120 ft. for the remaining distance between the back of the stope and the shaft level.

A raise was run from the sixth level to connect with No. 2 shaft, which was sunk 150 ft. from the surface. This shaft was continued downward and from it the seventh level was opened 200 ft. below the sixth. Stopes were started, and the ore was hoisted in 2-ton skips to the sixth level. Manway raises with crosscuts every 35 ft. were driven in alternate pillars to afford access to stopes for men and supplies.

The No. 10 adit was driven 7,735 ft. to intersect the ore body 490 ft. below the seventh level, and an electric haulage system was built to the mill. A raise and an ore pass were driven from the tenth level to connect with the seventh (*Figure* 3). When these were completed a cage was installed in the manway raise. The eight, ninth, and tenth levels are 168 ft. apart vertically. The ore dumped into the ore pass at the several levels is drawn into cars at the tenth level and hauled to the mill.

Shafts and Winzes

Three-compartment shafts are excavated 7 by 17 ft. in the clear. Timbers are 8 by 8-in. and are framed as shown in *Figure* 4. The two hoisting compartments are each 4 ft. 10½-in. by 5 ft., and the manway compartment 4 by 5 ft. The sets are placed on 6-ft. centers. The shaft timbering without any lagging outside the sets but with one compartment lagged with 3 by 12-in. plank requires 102 board feet per foot of shaft. Guides 4 by 6-in. in size are made from local red fir or spruce and are fastened to the end plates and dividers with ⅝ by 8-in. lag screws. Bearing sets are installed at intervals of 72 ft. The hoisting bucket and crosshead for sinking are operated in the manway compartment. At present (Sept., 1929) the sinking hoist at No. 3 shaft is installed on the twelfth level and sinking is in progress 435 ft. below. The bucket is dumped at the fourteenth level into a pocket from which the broken rock is

drawn into the 2-ton skips and hoisted to the tenth level. The sinking bucket is 28-in. in diameter by 28-in. high and is made of 3/16-in. steel. A tail chain is 3 ft. long and made of ⅞-in. iron; a ⅝-in. plate 8-in. in diameter is secured to the free end of the chain. The other end of the chain is fastened to the bottom of the bucket. When the bucket is hoisted for dumping, a door manipulated by the hoistman by means of an air cylinder and cable is dropped across the shaft, as shown in *Figure* 5. The door is made of 3 by 12-in. plank covered by a ¼-in. steel plate raised 8 in. above the plank at the upper end, as shown in *Figure* 6. The plate curves to join the plank at the lower end and has a slot in the raised portion to engage the button or plate, causing the bucket to dump when it is lowered. If the chain should break, the plank would keep any loose parts from falling down the shaft and injuring the workmen.

Shafts are sunk on contract. The crew consists of four men each on three shifts. The contractor usually works on day shift. Fifty-five pound jackhammers, each equipped with a line oiler, are used in drilling. The drill steel is 1-in. hollow-hexagonal with 4¼-in. shank. The bits are the regular cross bits with the standard double taper. The starters have a gage of 2½-in. to permit the insertion of a short piece of 2-in. pipe in the collar of the hole to keep out dirt and water for the remainder of the drilling. The next steel has a gage of 1⅞-in., and for each change thereafter the gage is reduced 1/16-in. The starters are 24 in. long and succeeding pieces increase 15-in. for each change. Cut holes are put in about 7½ ft. deep and the remaining holes about 6 ft. deep. Usually 28 sets of steel, five lengths to a set, are required per round. The shaft round consists of 32 holes as shown in *Figure* 9. The time required to drill a round is as follows: 1 hour to get equipment ready for drilling, 5 hours drilling, ¾ of an hour to remove machines and tools, ¾ of an hour to load and blast.

In blasting, two boxes of 60 percent strength dynamite are required per round, or an average of about 7 sticks per hole. Electric delay detonators are used and are inserted in the third stick from the bottom of each hole. The blasting circuit consists of No. 18 insulated wire leading down the shaft from a blasting switch connected to a 220-volt circuit at the level. The cut holes are blasted in pairs to prevent the breakage of timbers. The primers are connected in parallel to two bare wires stretched across the shaft. The primers required per round are as follows (*Figure* 9): 2 Instantaneous, 2 No. 1 Delay, 4 No. 2 Delay, 4 No. 3 Delay, 4 No. 4 Delay, 4 No. 5 Delay, 4 No. 6 Delay, 4 No. 7 Delay, 2 No. 8 Delay, 2 No. 9 Delay.

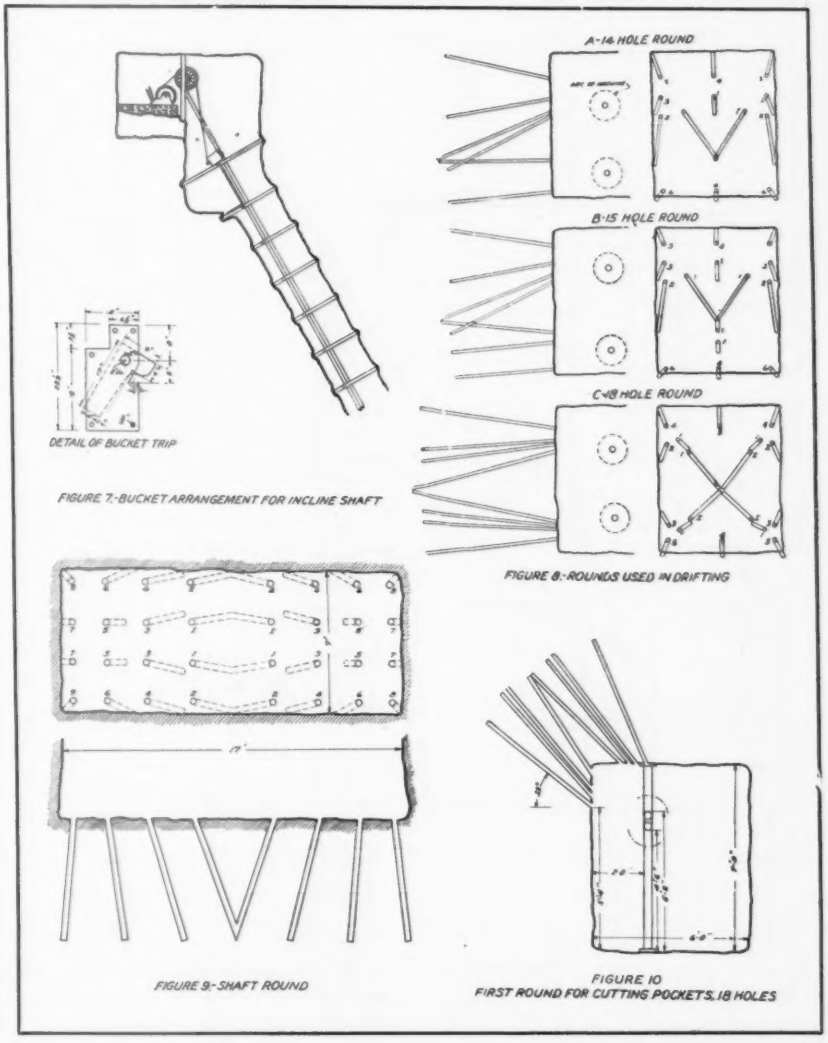


FIGURE 7.-BUCKET ARRANGEMENT FOR INCLINE SHAFT

FIGURE 8.-ROUNDS USED IN DRIFTING

FIGURE 9.-SHAFT ROUND

FIGURE 10
FIRST ROUND FOR CUTTING POCKETS. 18 HOLES

The two last holes are fired on the side away from the bucket to throw the broken rock closer to it and save handling. Two shifts are required to remove the broken rock after a blast. The drilling and mucking cycle is repeated until enough progress is made to place two sets and still have about 8 ft. between the shift timbers and the top of the broken rock. One shift is required to place the two sets and move the bulkhead preparatory to drilling. The bulkhead consists of 8 by 8-in. timbers covering two compartments of the shaft; it protects the sinking pump which is directly above it from flying rock and also provides storage space for machines and equipment. In timbering operations the blasting set is lowered by means of the hoist cable on one end and chain blocks on the other. The blasting set is held in place by ⅜-in. sling chains with grabhook ends. The wall plates are then lowered and suspended by ¾-in. hanging bolts. The end plates, dividers, and posts are put in next, the hanger bolts are drawn up and the timbers wedged in place. The operation is repeated for the next set. The bulkhead is then moved down to the bottom set, and the guides are installed for the crosshead and bucket. The sinking pump is lowered to the bulkhead; pipes are extended when there is sufficient room for a length. The working face is lighted by four 100-watt lamps attached to a rubber drop-cord suspended from a reel.

In sinking inclined shafts or winzes, a sinking bucket is used that has a 2-in. rod projecting 6-in. beyond the sides fastened to the bottom. This rod is engaged in a notch at the dump and allows the bucket to tip over when the cable is lowered. The bucket is then raised over a trigger which causes the rod to slide over the notch when lowered. The arrangement is shown in *Figure* 7.

Drifts and Crosscuts

Drifts and crosscuts are driven 6 by 7 ft. in section with an 8 by 8-in. drain

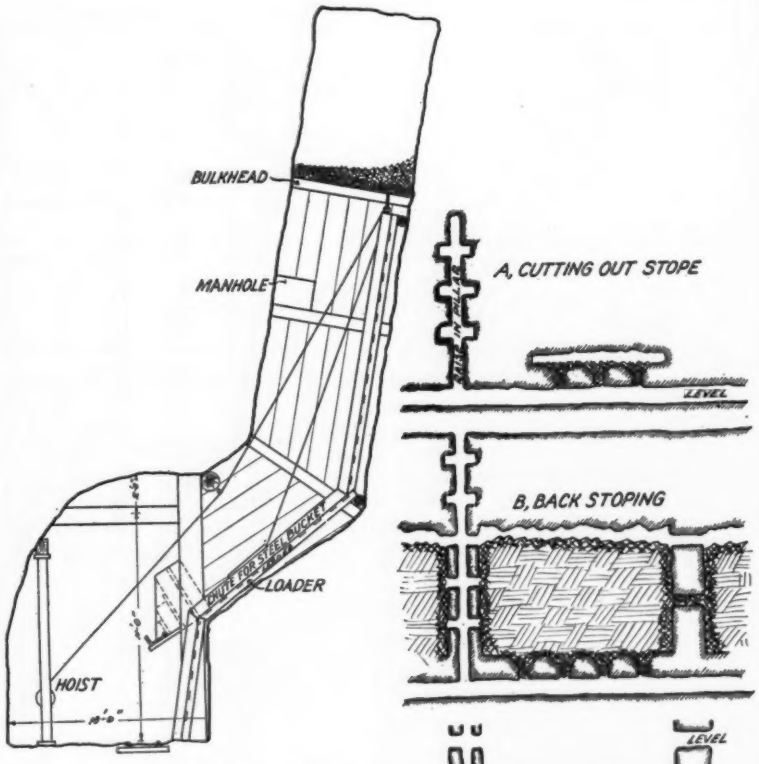


FIGURE 11.-MANWAY RAISE

FIGURE 12.-METHOD OF STOPING

ditch at the side. Practically all long drifts are advanced by contract, and the miners and muckers participate equally in the earnings of the contract. When speed in driving is desired, a round is drilled with one machine and blasted on every shift. This necessitates the use of a crossbar mounting with as many holes as possible put in from the top set-up. The 14-hole round is used (*Figure* 8-*a*) when the rock is hard to drill but relatively easy to break because of its brittleness, or when drilling time is limited. Usually, however, either the 15-hole (*Figure* 8-*b*) or 16-hole round is drilled. The average footage drilled per shift in development headings in 1928 was 11.3 holes, 5.2 feet deep, or a total of 58.76 feet. If it is found upon removal of the broken rock that the top portion of the round has been drilled a little high, a reliever is drilled from the bottom set-up, half way between the bottom cut hole and the center lifter. For the top set-up the bar is placed about 2½ ft. below the back of the drift. The bottom set-up is made with the bar resting on a powder box on edge with two wedges on top. The bar is 3½-in. outside diameter and is made of extra heavy pipe. The drifting machines have a 3 or 3½-in. bore and use 1¼-in. hollow-round lugged steel. The machines weigh 150 pounds fully equipped. All the drill steel has the standard cross bit with the 5° and 14° tapered sides. The gage of starters, beginning with 2¼-in., is reduced ⅛ in. for each change in length. The steel is made up in 18-in. changes and is the same as the steel used in the stopes, except that the shorter lengths of each change are sorted out by the tool nippers for use in the drifts.

The drifting crew consists of one miner and two muckers. It usually takes from one-half to three-quarters of an hour to bar down loose rock and set up the machine. Actual drilling takes about five hours, but there is usually some delay in removing the broken material for the bottom set-up, so that ordinarily six hours elapse between the start and the finish of drilling. Three-quarters of an hour is needed to remove the drilling equipment, load the holes, and place the shoveling sheets. These sheets are ¼-in. rolled steel 4 by 6 ft. in size. The muckers assist the miner in setting up and tearing down his machine. The broken material is shoveled into 1-ton round-bottom cars and trammed by hand to the station.

Usually in loading holes 25 sticks of 60 percent strength extra gelatin are placed in the cut holes and the rest of the holes are loaded with a box of 40 percent strength dynamite. Electric primers are used which are connected in series and fired from the same circuit as the stope holes. The primers are put in the third stick from the bottom. Powder is delivered to the miner by the steel nipper.

The 18-hole round is drilled only when a clean set-up can be made, and the machine is usually mounted on a cross arm attached to a vertical column. *Figure* 8-*c* shows this round as drilled from a crossbar; the difference in placing of the holes by the two methods of supporting the drill is only slight. The 18-hole round can seldom be drilled and blasted in one shift; therefore, the holes are drilled deeper—6½ to 7 ft.—and the time of drilling is extended over two shifts. This procedure is followed by men drilling on company time. The 18-hole round takes about 15 pounds of 60 percent strength dynamite for the cut holes and 60 pounds of 40 percent for the remainder of the round. The round breaks from 5 to 6 ft., and about 1½ shifts are required to shovel the broken material.

The No. 10 adit is 8 by 8½ ft. in cross section; it was driven under a bonus system. A distance of 7,686 ft. was driven in solid rock in 699 days, an average of 5½ ft. per shift. The round used was drilled by three machines from a crossbar, one machine being run by the shift boss. The crew worked in two shifts; a round was drilled, blasted, and material from the preceding round shoveled on each shift. Sometimes 12 hours was required to finish the round. Four muckers worked on each shift; two men loaded a 3-ton car and pushed it past a siding where the empty cars stood, while the two others rested and waited their turn for the next car. A tool sharpener and a helper working on day shift laid pipe and track when they had finished sharpening the steel. A foreman was in charge of the work and participated in the bonus. The men were paid the following daily wage:

1	Foreman	$6.00
2	Shift bosses	5.00
4	Miners	4.50
8	Muckers	4.00
1	Tool sharpener	5.25
	Tool sharpener helper	4.00
17		

The average progress per month was about 330 ft. The bonus started at 210 ft. and was paid as follows:

From—(feet)	To—(feet)	Amount paid per foot	Footage	Amount of bonus paid
210	219	$2.00	10	$20
220	229	3.00	10	30
230	239	4.00	10	40
240	249	5.00	10	50
250	259	6.00	10	60
260	269	7.00	10	70
270	279	8.00	10	80
280	289	9.00	10	90
290	299	10.00	10	100
300	309	12.00	10	120
310	319	14.00	10	140
320	329	16.00	10	160
330	339	18.00	1	18
Total bonus paid for average monthly advance of 331 feet				$978

The $978 was divided equally between the 17 men, making an average of $57.53 per month per man in addition to his regular daily wage. There were also a motorman and a dumpman on each shift who did not participate in the bonus. The adit was driven at a cost of $30.93 per foot in hard rock, not including the preliminary cost and open-cut work.

Raises

Most of the raises in the mine are run in pillars for manways to serve stoping operations. A manway raise is made 6 by 8 ft. in cross section and is run at an angle of 60° or more from the horizontal. The first round for a manway raise is drilled from the drift at 45°, as shown in *Figure* 10. The next three rounds are also drilled with drifter machines at the 45° inclination, and after that the raise is run on a steeper angle and self-rotating stopers are employed.

In starting a raise the first three rounds and the cut holes of the fourth round are blasted before building the chute. After the chute is in place the remainder of the fourth round is fired. This procedure avoids breaking the chute timbers. The chute consists of 18-in. round timber spragged in position on 5 1/3-ft. centers. The chute and manway compartments are lined with 3 by 12-in. plank nailed to the 18-in. round timbers. The plank lining is carried to within 6 ft. from the face. A bulkhead of round pole lagging 8 in. in diameter is placed over the manway side of the raise before rounds are fired. The chute and manway compartments are each 3½ by 6 ft. in the clear. In the manway compartment a slide is constructed for transporting timber, steel, and drilling equipment to the back of the raise (*Figure* 11). The slide is built of 2 by 10-in. plank and is adjacent to the chute compartment. After the installation of the chute the raise is put on a contract basis.

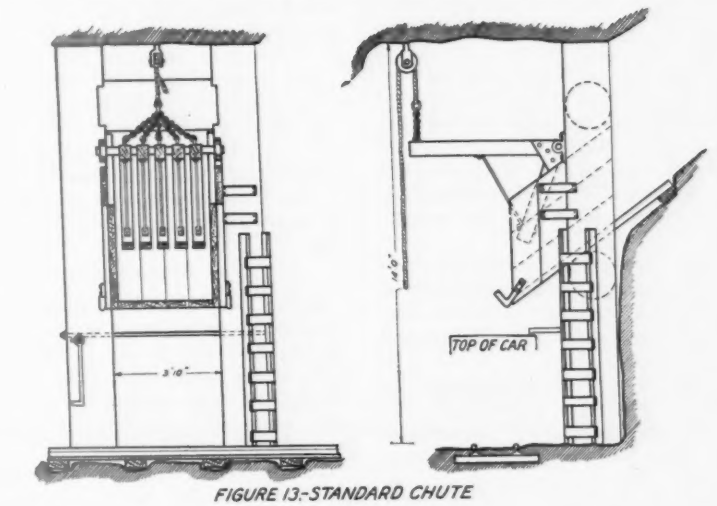


FIGURE 13.-STANDARD CHUTE

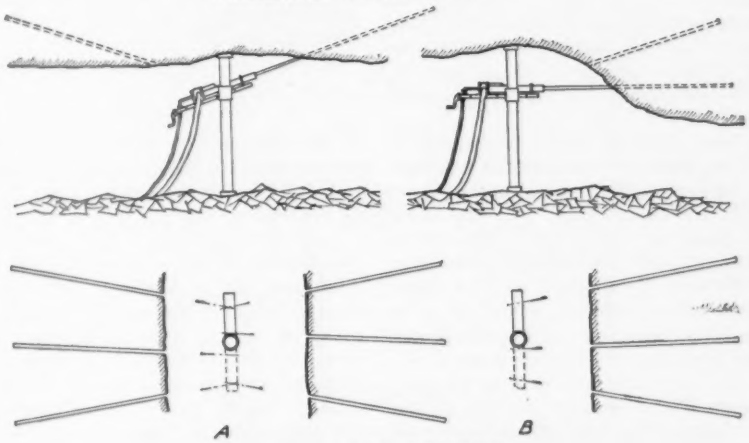


FIGURE 14.-STOPE ROUNDS

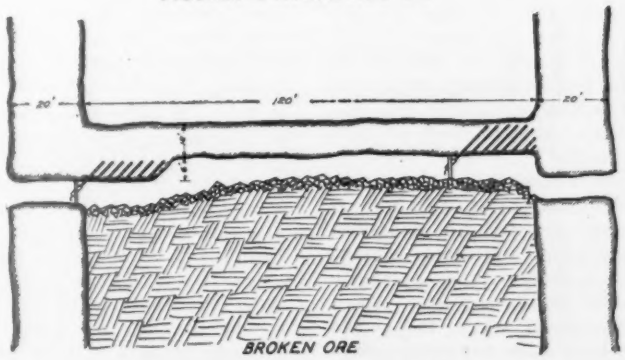


FIGURE 15.-REMOVING SHEET PILLAR

The raises are from 175 to 200 ft. long. Manway crosscuts 5 by 6 ft. in cross section are run on both sides of the raise at intervals of 25 ft. vertically above the first crosscut. Stoping on both sides of the pillar is done concurrently with the raise work. However, owing to the danger of falling rock a raise is generally not used to serve a stope until the raise is completed. Therefore, the first crosscuts from the raise are run at the elevation that the top of the stope will have reached when the raise is completed.

Because of the gases from blasting it is customary to work only one shift per day in the long raises. Two men work on a shift; they stage-up, drill with two machines, and blast in the raise each working shift until the raise is beyond the position for a crosscut. The raise is then lined and the bulkhead built a foot below the floor elevation of the

crosscut. Two drifters are set up on the bulkhead, and crosscut rounds on either side of the raise are drilled and blasted. A second round is blasted in both crosscuts before resuming the raise work. An average of 4 ft. per round is made in both the raise and the crosscuts. In a month's time drilling occupies 20 shifts and timbering 10 shifts for both men. Enough broken rock is drawn from the chute each day to allow for the next blast.

Stoper raise rounds consist of from 14 to 18 holes and are blasted with electric primers. Pyramid-cut rounds similar to those used in drifting are used in the raises.

In raise work the cost of upkeep of automatic stopers is about $1.50 per shift per machine, which is considerably higher than the cost for hand-rotated machines. The drilling speed for the automatic stopers, however, is such that about an hour less is required for drilling a round. In long raises this justifies the increase in expense of upkeep over hand-rotated stopers or mounted drifters.

Figure 3 shows the arrangement of the ore pass and the manway and supply raise connecting the seventh, eighth, ninth, and tenth levels. The two raises are separated by a rock pillar 20 ft. thick. At each level, with the exception of the tenth, grizzlies are installed which consist of 85-pound rail spaced so as to give 13-in. openings. At the eighth and ninth levels the ore transfer raise is offset, and a finger chute-gate is installed at each level to control the flow of ore. The finger gates hold ore in the upper parts of the ore pass when desired to provide room for dumping the ore trammed on either the eighth or ninth levels. To reopen the ore pass in the event of the ore hanging-up, drifts were driven connecting the manway raise and the ore pass raise at intervals of 40 to 60 ft. vertically.

At the bottom of the ore pass two loading chutes were constructed of reinforced concrete and steel. The reinforced concrete portion of the chutes consists of a wall 1 ft. thick with the necessary openings for the gate plates. Loose ground encountered where the chutes were to be built made concreting necessary. The chutes are built of sheet steel with manganese steel liners. The chute gates are of the undercut arc type operated by compressed air cylinders with four-way valve controls. To further control the flow of ore two heavy 700-pound cast-iron weights are hung in the chute on a shaft above the gate. The use of these weights enables a larger chute opening to be used, thus affording more room for barring-down large pieces of ore. The cast-iron weights were too easily broken when blasting large bowlders in the chutes, but this difficulty was overcome by jacketing the weights with sections of worn roll shell. Above the drift a wooden loading platform gives access to the chute gates.

The manway raise is 6 by 9 ft. in cross section and consists of one manway and one cage compartment. The hoist for the cage is at the bottom of the raise, and the ⅞-in. hoisting cable passes up the manway and over a sheave to the cage compartment at the top of the raise.

Stoping

As previously stated, the present stoping practice in the main ore body is to leave pillars 20 ft. thick across the width of the stope at intervals of 90 to 120 ft. Manways with crosscuts to the stope every 25 ft. vertically are driven in alternate pillars (*Figure* 12). The pillars are located vertically over the pillars of the stope below. Stopes outside of the main ore body are mined without pillars.

Ore is drawn from the stopes through chutes placed 30 ft. apart in a drift along the footwall of the ore body.

The three stages of work in shrinkage stoping, i. e., cutting out, back stoping, and drawing the finished stope, must be kept going continuously to maintain a uniform output from the mine. Development work must be kept far enough in advance not to hold back work in the stopes. When drifts and crosscuts are advanced far enough on a level the raises for the manways and chutes are started. At the chutes the drift is cut out to a height of 14 ft. above the rail. The chute raises are started in the same manner as the starting of the manway raises previously described. Standard chutes (*Figure* 13) are installed. After the chutes are in place the chute raises are extended to a height of 32 ft. above the rail. The raises are then belled out and connected with each other as shown in *Figure* 12-*c*. An 18-ft. pillar is left between the top of the drift and the bottom of the stope. Practically all the ore is withdrawn in cutting out, leaving a room the width of the ore body and 7 ft. high. One of the chute raises is used as manway through which air and water lines and supplies are taken into the stope until the back of the stope reaches a crosscut of a regular manway. After cutting out operations are completed, stoping in the back is started. Rounds are drilled with drifters as shown in *Figure* 14. In flat backs two rounds are drilled in opposite directions from the same set-up. These rounds consist of a single row of three holes in narrow stopes drilled at an upward angle and four holes in wide stopes. By this procedure two rounds can be drilled and blasted without burying any oversize bowlders. Breast rounds consist of two rows of holes drilled as shown in *Figure* 14-*b*. The average depth of the holes in the stopes is about 7.7 ft. During the year 1928, an average of 7.3 holes totaling 56.2 ft. was drilled per manshift in stoping. The stope rounds are blasted with 40 percent strength ammonia dynamite in 1⅛ by 8-in. cartridges. Seven cartridges is the average number used per hole.

Stemming in cartridge form is supplied for blasting all rounds. It consists of a mixture of sawdust and clay. The mixture is poured into the paper shells dry and then dampened with water. The sawdust holds the moisture until it is absorbed by the clay. The stemming shells are red to distinguish the stemming from the powder.

The labor and material cost of excavating a chute raise and station is as follows:

	Labor	Material	Total
Miner, 10 shifts	$50.00	.....	$50.00
Mucker, 10 shifts	45.00	.....	45.00
Explosives	.....	$36.63	36.63
Totals	$95.00	$36.63	$131.63

All chutes for the stopes are equipped with finger-type gates, and each chute has an opening 3 ft. wide and 2 ft. high when the fingers are fully raised (*Figure* 13). The labor and material required and the cost of installing a stope chute with finger gate are as follows:

	Labor	Material	Total
Iron lining and brace	$3.44	$6.75	$10.19
Lumber	4.29	3.75	8.04
Chain	1.37	.96	2.33
Eyebolt	.52	.30	.82
Sheave	1.72	scrap	1.72
Shaft 2-11/16 inches by 6½ feet	.....	8.78	8.78
Shaft housing	2.03	2.65	4.68
Shaft housing bolts	.....	1.00	1.00
Two shaft collars and 4 washers	1.37	scrap	1.37
40 feet round timber at 8¾ cents per foot	.....	3.50	3.50
60 feet round timber at 6 cents per foot	.....	3.60	3.60
384 bd. ft. 4 by 12 inch timber at $25 per M	.....	9.60	9.60
3/16-inch steel for bottom	.....	6.40	6.40
3/16-inch sheet steel for cap and sides	.....	6.91	6.91
Rod ¾-inch by 8 feet	.34	.60	.94
Cap hooks	.69	scrap	.69
Stop board	.69	.....	.69
15 feet ¾-inch rope	.....	.53	.53
Labor building chute, timberman and helper	70.00	.....	70.00
Caps and powder for hitches	.....	2.00	2.00
Totals	$86.46	$57.33	$143.79

The crew in a stope consists of a miner and a mucker for each face in cutting-out operations. After back stoping is started one to three miners and one or two pluggers work in each stope, depending on the size of the stope. The pluggers help the drillers to set up, and spend the rest of the time in plugging large bowlders and in breaking the smaller oversize fragments with a hammer. No blasting chambers are used over the chutes, and as many of the large pieces as possible are broken in the stope after being blasted down.

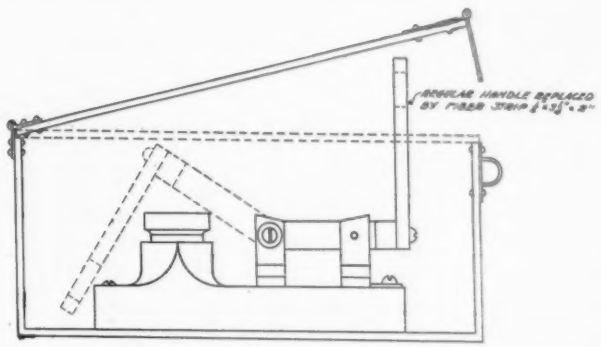


FIGURE 16.-ELECTRIC BLASTING SWITCH
D.P.S.T. SWITCH AND FUSE BOX

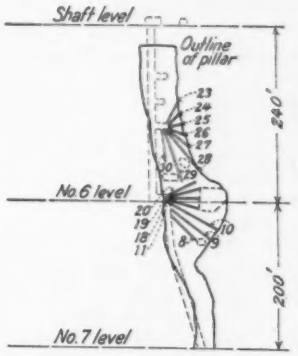


FIGURE 17
POSITION OF DIAMOND DRILL HOLES IN PILLAR

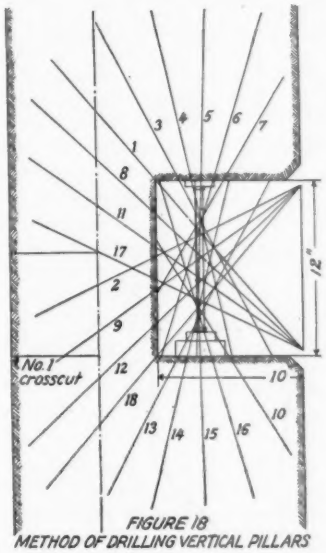


FIGURE 18
METHOD OF DRILLING VERTICAL PILLARS

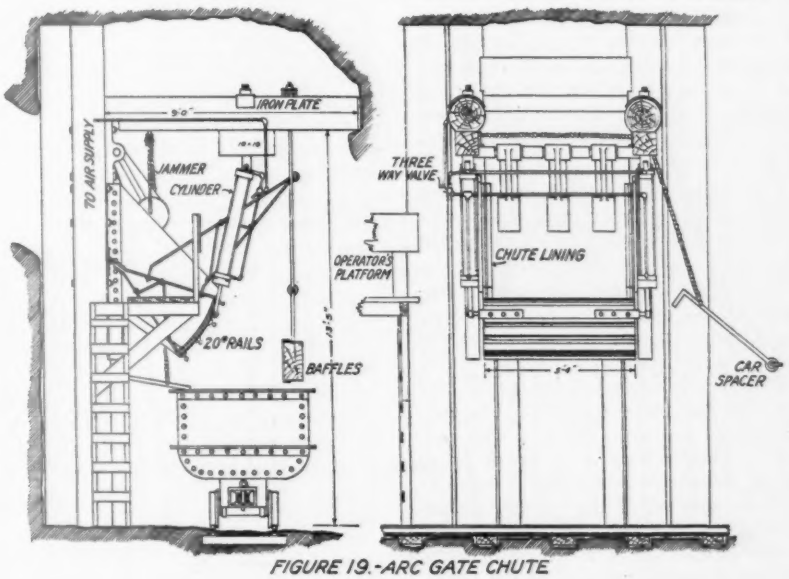


FIGURE 19.-ARC GATE CHUTE

On day shift the drillers bar down the back, set up their machines and drill during the rest of the shift. No holes are blasted on day shift, except when, as occasionally happens, the round has misfired on the preceding shift. The miners on the night shift continue the drilling, tear down the machines, remove the equipment to a safe place, and load and blast the holes.

A 2-in. pipe is used for air and a 1-in. pipe for water. These pipe lines have short lengths of rubber hose inserted at every other joint to give flexibility to the pipe lines. A pipeman and a helper lay the pipe in the stope at the beginning of each day shift.

The average routine machinemen in the stopes is as follows:

Operation	Day shift hours	Night shift hours
Barring-down	2	.....
Setting-up	1	.....
Drilling	5	6
Tearing down and removing equip.	.....	1¼
Loading holes	.....	¾

Electric Blasting

Stope rounds are blasted electrically; the primers are connected in series. The plugger holes are also connected in series and both circuits are connected in parallel to lead wires extending from the stope but not connected to the blasting line. When loading is completed the lead wires are connected, and the shift boss, after checking over the men to see that all are at the station at the end of the shift, throws in the switch which sets off all blasts on the level. When electric blasting was first started a blasting crew loaded and blasted all holes between the night and the day shifts. This practice has been changed to that of having the miners load their own holes. The blasting circuit is 220 volts. A switch box shown in *Figure* 16 is located at the station of each level. The box is made of 18-gage galvanized iron and contains a 2-pole knife switch with fuse plugs in series and with a handle so constructed that the door of the box can not be closed and locked unless the switch is open. Only the shift boss carries the key, and as an added safety precaution he usually carries the fuse plugs in his pocket also.

Removal of Sheet Pillars

The stopes are carried to within 20 ft. of the level above, at which point back-stoping is discontinued until the stope above has been emptied. The back is then mined up to the level in the usual manner. At the level the angle of the holes is changed from nearly flat to 45°. The first cut, as shown in *Figure* 15, is drilled with holes 9 ft. deep and 4 ft. apart. The holes are blasted in groups of 10 or 20 at a time, according to the ground; the bench is carried the length of the stope. The next cut brings down the remainder of the pillars. In weak ground the second cut follows closely behind the first one.

In removing a sheet pillar from the level to the bottom of the stope above, an average of 75 tons is broken per machine shift as compared with an average of 27 tons for shrinkage stoping.

No attempt is made to break up the oversize in the stope after the last bench is shot. This results in a lot of large bowlders that must be shot in the chutes when the broken rock is nearly all drawn from the stope. As the bowlders hang-up some distance above the mouth of the chute, it is necessary to use powder on the smaller fragments around the edges of the bowlders in order that they may be brought down and drilled in safety. Powder consumption is therefore considerably higher in chute blasting during the last stage of drawing than at first.

Removal of Vertical Pillars

Vertical pillars containing a total of 146,526 tons have been removed between the tenth and the shaft levels at a cost of 58 cents per ton for ore broken by air-machine drilling and of 28 cents per ton for diamond drilling. Of the above tonnage, 19 percent was broken by machine-drilled holes and 81 percent by diamond-drilled holes.

The removal of vertical pillars was made possible by the firmness of the walls of the emptied stopes between the upper sheet pillar at the shaft level 300 ft. from the surface, and the lower sheet pillar at the tenth level 932 ft. below. As a precautionary measure against dilution in the event of caving, all of the stoping ore is extracted before the removal of the vertical pillars. The pillars are then removed one at a time and most of the resulting ore is drawn from a stope before the next pillar is blasted.

In the removal of the vertical pillars machine drilling was first tried. Some of the pillars had 6 by 8 raises with manway crosscuts at intervals of about 35 ft. vertically. These pillars were attacked first; benches were cut at each manway crosscut across the width of the pillar, beginning at the upper manway crosscut. The benches were all cut on the same side of the pillar, as inclined cleavage planes caused the rock to break to smooth sloping surfaces, making it impossible to maintain a safe working floor on the opposite side of the pillar.

In starting a bench the first holes drilled from the manway crosscut were parallel to the face of the pillar, and were blasted one at a time with little burden to prevent broken rock from falling down the raise. As the bench was advanced, several holes in a row were fired simultaneously. Each bench was 12 to 14 ft. high and from 10 to 14 ft. wide. On completion of the bench, holes were drilled from the benches with machine drills (*Figure* 18). The holes had an average depth of 11.5 ft. and were spaced so that the bottoms of two adjacent holes were about 4 ft. apart.

The drill steel had an average run of 18 in. Starters were 3½ ft. long with 2¼-in. gage. The gage on succeeding bits was reduced ⅛-in. for each change of steel up to the 9½-ft. length. From 9½ ft. to 14 ft. the gage was reduced 1/16-in. per change, making the bit on the 14-ft. steel 1 9/16 in.

The up-holes were drilled without difficulty, but trouble occurred in drilling the down-holes as the long steel stuck when broken ground allowed the water to escape. At the start, one machine operated by a miner and a helper worked on a bench; later two machines per shift were run on the same bench by two miners who assisted each other in setting up the machines and in changing the long steel.

In blasting the upper part of the first pillar, 828 holes were fired simultaneously. The holes were loaded with 5,500 pounds of 60 percent strength gelatin dynamite and were detonated with instantaneous electric detonators. Groups of 10, 20, 30, 40, and 50 primers in series were connected in parallel to the main lead wires. The lower numbered series in each case were placed in the outside holes of the pillar to take advantage of any time interval that might exist between the series. This method was used in preference to that employing parallel groups of 50 primers in series, to avoid the possibility of an inside group of holes firing before the outside. A 440-volt circuit was used to ignite the primers. The pillar broke clean, and only a few large bowlders were observed in the stope after blasting.

After the first pillar was removed, a second pillar 440 ft. high was attacked at the end of a stope. In this pillar the

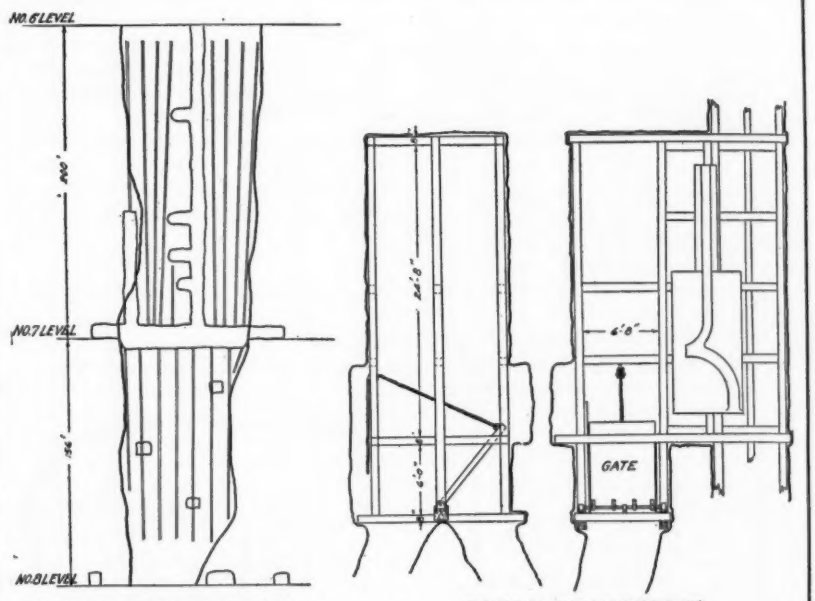


FIGURE 20.- PARALLED DIAMOND DRILL HOLES FOR REMOVING VERTICAL FILLER

FIGURE 21:-SKIP DUMP STATION

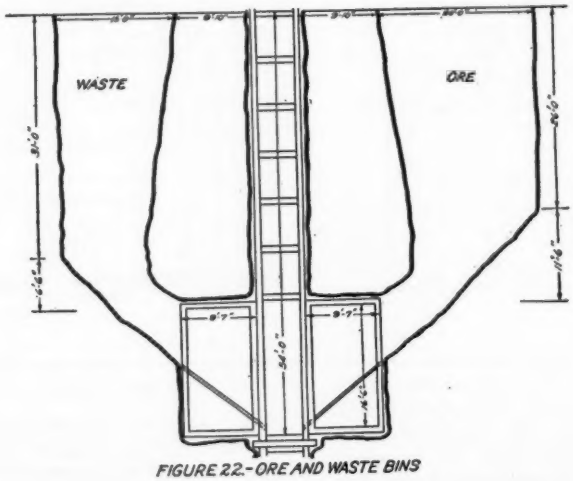


FIGURE 22.- ORE AND WASTE BINS

manway crosscuts were on only one side of the raise for a distance of 200 ft. At a point 100 ft. from the top of the pillar a blast in cutting out a bench knocked off a large slab on the opposite side of the pillar. This left the bench in an unsafe condition for further working. Furthermore, a little lower than this bench, stoping operations had removed a portion of the pillar on the hanging-wall side, so that the continuance of benching was extremely hazardous. Diamond drilling was therefore resorted to in drilling the remainder of the pillar. With the benches already cut, sufficient room was available to set up the diamond drill and put in two sets of fanning holes. The holes were all in the same plane through the center of the pillar. *Figure* 17 shows the outline of the pillar and the arrangement of the holes. In pillars subsequently removed the diamond-drill holes were drilled parallel to each other 10 ft. apart as shown in *Figure* 20. Diamond drill holes were 2¼ in. in diameter and were drilled on contract at $3.50 per foot. In some cases suitable stations could not be obtained for parallel holes, and the fan holes 10 ft. apart at the bottom had to be used. In drilling inclined holes the machine was adjusted to the desired angle for spacing the holes by means of a clinometer held on the drill rod. The drill holes were platted on a vertical transverse section of the pillar drawn on paper.

When necessary to drill through a crosscut by the diamond drill, casing was inserted at the crosscut. The lengths of the holes ranged from 20 to 207 ft. for down holes and 20 to 183 ft. for up-holes.

When drilling in the previously mentioned pillar was completed, there were 1,835 ft. of machine-drilled holes averaging 11.9 ft. deep and 741 ft. of diamond drill holes averaging 49.4 ft. deep. The machine-drilled holes were loaded with 60 percent and the diamond-drilled holes with 90 percent strength gelatin dynamite. Electric primers and cordeau were used to detonate the respective holes. Preparing benches on this pillar broke 4,472 tons and the final blast broke 20,882 tons.

On account of the great length of some of the diamond-drill holes, special equipment was made for loading and tamping the explosives. For down holes a 10-ft. length of brass pipe weighted inside with an iron rod was used as a tamping tool. A section of shovel handle was screwed into the bottom end of the brass pipe. The wood portion of the rod was protected from wear by a piece of rubber air hose stretched over the end. In loading, two cartridges at a time were dropped into the hole and were followed by the tamping rod suspended by a ¼-in. flexible cable wound on a reel. One man raised and lowered the rod by windlass and the other man dropped the cartridges into the hole and jogged the tamping rod several times after it had reached the bottom. The number of turns on the windlass indicated whether or not the hole was being loaded properly. When properly tamped the 2¼-in diameter holes held about four cartridges, each 1¼-in. in diameter and 8 in. long, per foot of hole.

TIME AND AMOUNT OF DYNAMITE REQUIRED FOR LOADING UP AND DOWN HOLES WHERE DELAYS WERE ENCOUNTERED

Depth of down holes, feet	Number of cartridges loaded into hole	Number of cartridges per foot of hole	Time required to load hole, hours
72	290	4.0	4
83	344	4.1	4¾
118	493	4.2	7
Depth of up holes, feet			
180	811	4.5	30
173	726	4.2	24
181	747	4.1	32

Tamping rods for up-holes were made of red fir or spruce cut in 10-ft. lengths. The ends of the rods were fitted with brass joints. A ⅛-in. tapered knob projecting inward on the outside sleeve kept the joints from coming apart and in addition enabled the joints to be quickly connected or disconnected. The upper end of the first rod to enter the hole was fitted with a threaded piece of 1-in. brass pipe. This pipe held either a piece of hardwood for tamping or any one of the various fishing tools that were used. The speed of loading holes was increased by means of a device to hold the rods while attaching or detaching a length. It consisted of a tripod with legs of 1-in. pipe; the tamping rods pass through a 2½-in. pipe fastened to a plate on the tripod and are gripped by a cam actuated by a counterweighted lever. The rods are securely held while a section of rod is being removed or attached. The rods are released by raising a lever attached to a rope which passes over a pulley to a foot pedal. The long up-holes require a crew of three men to handle the rods.

In loading up-holes four cartridges were joined together by wooden pegs inserted in the ends. The principal trouble in loading both up and down holes was caused by broken rock working into the holes. In ravelly down-holes thin slip-jointed tubing was used. The powder and tools were lowered through the tubing and the tubes were withdrawn by cable attached to the bottom joint as loading progressed. The time and the amount of dynamite required for loading up and down holes where little delays were encountered is shown in the tabulation to the left.

The amount of chute-blasting required for run-of-mine ore from back-stoping in comparison with the blasting necessary in the same chute for ore broken by diamond-drill holes in the vertical pillars is shown as follows:

	Back stoping	Vertical pillars
Cost per ton for explosives and primers	$0.0154	$0.0832
Number of tons drawn from chute per shot	14.91	5.74
Number of cartridges per shot	2.8 (mostly 25%)	6.2 (mostly 40%)

As shown in the foregoing table, the ore from the vertical pillars broke much larger, necessitating a greater amount of blasting to enable it to be drawn through the chute. However, the oversize bowlders from back stoping were plugged in the stopes and any that were missed were plugged later in the chutes. No bowlders from the pillar ore were drilled in the stope or at the chute because of the possibility of missed holes. No missed holes, however, have been discovered to date.

The diamond-drill method was found to have the following advantages over machine drilling in extracting vertical pillars: The factor of safety was much higher, since the danger from falling rock could be practically eliminated as only a single bench is required for the diamond drill. In machine drilling each bench cut weakened the pillar and increased the tendency of the pillar to slough between benches. Once a bench was cut for diamond drilling there was no need for the men to work near the edge of the pillar where there is danger of slipping or falling over the edge into the stope. Cost per ton of rock broken was much lower, and the time required to drill and blast was considerably less. It is believed that the amount of blasting required at the chutes is less for the pillars broken by the diamond-drill holes than by machine-drilled holes from

COMPARATIVE COST OF BREAKING ORE IN VERTICAL PILLARS

Method	Tons in pillar	Number of holes	Length of holes	Total * cost of drilling	Total cost of loading and explosives	Total cost per ton of broken ore
Machine drill	7,475	1,205	12,144	$2,911.00	$1,439.40	$0.5819
Diamond drill	40,178	17	2,208	8,815.00	2,052.14	.2704
Diamond drill	11,205	6	688	2,446.00	289.62	.2441

* Total cost of drilling includes estimated cost of sharpening and replacing worn steel and the upkeep of machine drills, and cost of labor for drilling.

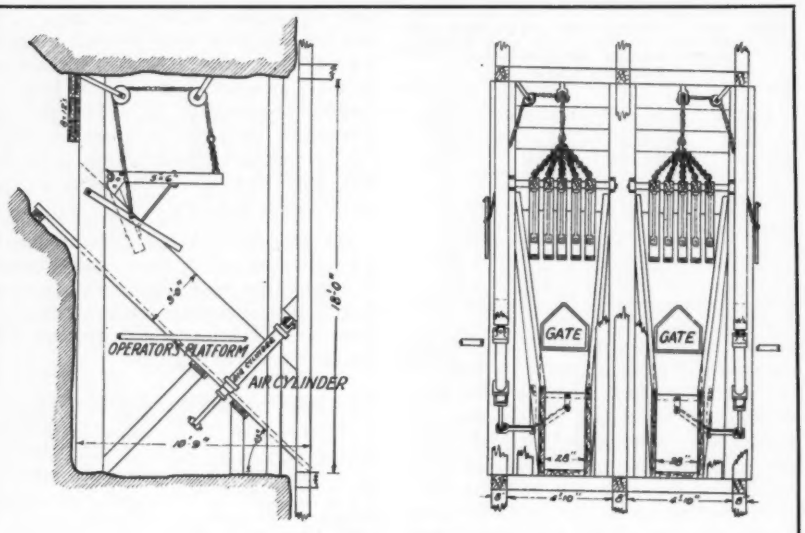


FIGURE 23.-SKIP LOADING CHUTES

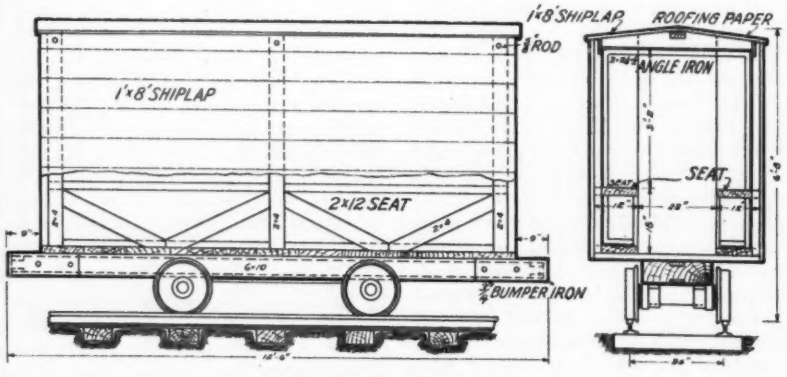


FIGURE 24.-MAN CAR

benches. The following data show the comparative cost of breaking ore in vertical pillars by the two methods:

Underground Transportation

Tracks on the main level consist of 20-pound rails laid on 4 by 8-in. ties 3 ft. long. The gage of the track is 18 in., and the grade is one-fourth of 1 percent in favor of the loaded trains.

Two 3-ton storage-battery locomotives are used for hauling trains on the haulage levels. A train consists of 10 one-ton round-bottom cars on all levels except the tenth. Some hand-tramming is also done from the stopes. The 1-ton cars require two men to dump. This is done by the brakeman and a man who works on the grizzly at the dumping pocket. The loading crew consists of three men who, with the assistance of the motorman, can load about 100 cars in a shift. The leader of each loading crew is a chute blaster who is responsible for the loading. In loading the cars, the smaller of the fragments too large to pass through the chute gate are bulldozed before they come up against the fingers of the gate. The large oversize bowlders are drilled with a stoper using long steel through the fingers of the gate. The holes thus drilled are blasted with 40 percent strength ammonia dynamite and electric detonators.

To facilitate stopping the cars at the right point beneath the chutes for loading, a hook that drops over the top of the cars is fastened to the wall or post at each chute.

The main haulage or tenth level has a 24-in. gage track of 30-pound rails laid on 5 by 8-in. ties 4 ft. long. The grade is one-fourth of 1 percent in favor of loaded trains. On this level 6-ton cars are used. A train of 10 of these cars is pulled by a 7-ton electric locomotive. The cars are loaded from the ore pass described in the section under development or from the tenth level stopes either through direct chutes or from bulldozing chambers. Undercut arc gates are used at the ore pass and finger gates at the chutes from the stopes and bulldozing chambers. In six hours a crew of four men will load 40 of the 6-ton cars from a stope in which there is considerable oversize. Two men can usually load 10 cars from the ore pass in 10 minutes. This ore has previously passed through a grizzly.

The grizzly area at ore pockets or at the ore pass is usually 7 by 18 ft. The grizzly bars consist of 80 or 85-pound rails spaced 13 in. apart in the clear. The ends of the rails fit into notches cut in 24-in. round timbers and are held in place by bars bolted to the timbers.

All ore from below the tenth level is hoisted in 2-ton skips and dumped into bins from which loading is controlled by arc gates of the type shown in *Figure* 19. A large door lined with rails diverts the material from the skips into either the ore or waste loading bins (*Figure* 21).

Figure 22 shows the arrangement of the ore and waste bins at each level. The space at the bottom of the bins and at the side of the shaft is occupied by the gates and loading station.

With the 2-ton skips 450 tons of ore and waste are hoisted per day. As the skips are busy during the day shift in transporting timber, steel, powder, and other supplies, most of the hoisting is done on the night shift. The hoist has a rope speed of 800 ft. per minute and is operated by a 150-horsepower motor. An additional 225-horsepower motor is being installed to operate two 5-ton skips in order to handle a larger tonnage. The space between grizzly rails at the skip pockets will be reduced to 11 in. to facilitate skip loading.

A typical skip chute is shown in *Figure* 23. The skip tender has some trouble in loading the 2-ton skips without spilling on account of the size of the rock. The air-controlled slide worked in conjunction with the fingers prevents overloading of the skip to a great extent. It is anticipated that the 5-ton skips will give less trouble from overloading.

Transportation of Men

The men are taken to and from the No. 10 raise on the tenth level in closed cars or "Pullmans" (*Figure* 24.) Each car holds from 10 to 12 men. The forward car is equipped with a double door to keep the cold air in winter time from blowing through the cars.

Percentage of Extraction

Above the tenth level, 2,901,180 tons of ore have been mined, and it is estimated that there are 107,728 tons of ore remaining in the pillars. This makes an extraction of 96.42 percent. By using the same mining methods below the

tenth level, the extraction will probably be at least 95 percent from the lower levels.

Wage Scale and Contract Rates

The following wage scale for the principal classifications of underground employes was effective in October, 1929:

Brakemen	$4.50
Car loaders	4.50
Chute blasters	5.00
Hoistmen	5.00 and 5.75
Jackhammer men	4.75
Machinemen	5.00
Motormen	5.00
Muckers	4.50
Pipe and trackmen	5.00
Timbermen	5.00 and 5.50
Timbermen helpers	4.50
Shift bosses	6.00
Skip tenders	5.00

All employes in underground operations are paid twice a month for the time worked up to 10 days before the pay day.

Most of the development work is contracted at prices which vary according to working conditions. Six by seven drifts are contracted at $9 per foot, the contractor furnishing his own explosives and removing the broken rock to the bins at the station. Manway raises 6 by 8 ft. in cross section are contracted at $9.75 per foot for the first 100 ft. and are increased $1 per foot for each additional 100 ft. above the level. Crosscuts from the raise are paid for at the same rate. The contractor furnishes his own explosives. The company draws rock from the raise as requested by the contractor. In sinking a 7 by 17 ft. shaft the contract price is $50 per foot of shaft. The contractor furnishes the explosives required and the necessary rubber clothing. The company furnishes all other supplies and a hoistman to operate the sinking hoist.

Board at the company boarding house costs $1.25 per day, and furnished rooms in the dormitory maintained by the company cost $4 per month. Hot coffee is served underground at the various stations at lunch time.

Ventilation

Ventilation is natural. In long drifts and in shaft sinking blowers are used to clear out the powder gases.

Safety Methods

Fire hazards are negligible, as very little timber is used in the mine. Chutes and shaft timbering comprise the main usage. The shafts are usually wet or dampened with water for the preservation of timbers.

Conditions in the mine and plans for their betterment are discussed at a general meeting of the shift bosses and foremen on the first change day of each month. A list of accidents of the preceding month is made up and the means to be taken for preventing the recurrence of similar accidents are discussed. It is desired to have the shift bosses educate the men under their supervision in safe methods of working, as well as to obtain quantity in production. The safety meetings are of considerable value in giving a general understanding of what is wanted, and they impress upon the bosses the importance of instruction in safe methods of working.

Administration

The superintendent sees that all departments function smoothly and in harmony, directs the mine foreman in development and mining work, and checks up on the results obtained.

The mine foreman hires the men and confers with the superintendent in regard to promotions. He directs the shifters as to location of set-up and general direction of drilling for machines; designates chutes and amount to be drawn, lays out the details of development, controls the steel-sharpening and repair work of the blacksmith, and orders all supplies.

The shifters instruct the miners where to set up; the number, direction, and depth of holes to drill; the amount of powder to use; give the trammers their instructions, and keep the time and record of performance of men underground.

The steel nippers take sharp steel to the miners and remove dull steel from the stopes. A nipper on each level issues powder at the magazine and reports amounts used and the location to the shifter. The other nippers get the order from the miners for explosives and deliver it to the miners.

The mine electrician is responsible for the upkeep of all motors and locomotives underground, as well as of the power and the phone circuits. He takes orders from the mine foreman or shifter to make minor repairs in case of breakdown and arranges with the mine foreman for time to make major repairs. Any problems that arise are taken up with the chief electrician. The mine foreman may call on the master mechanic or chief engineer for any work out of the ordinary.

TABLE 1—SUMMARY OF COSTS

Year of 1928.
Tons of ore hoisted: 303,301.
Mining method: Shrinkage with pillar support.

UNDERGROUND COSTS PER TON OF ORE HOISTED

	Labor	Supervision	Compressed air, drills, steel, and power	Explosives	Timber	Other supplies	Total
Development	$0.266	$0.021	$0.054	$0.110	$0.015	$0.013	$0.479
Mining	.378	.033	.135	.157	.017	.040	.760
Transportation	.384	.016	.....	.....	.....	*.038	.438
Totals	1.028	.070	.189	.267	.032	.091	1.677

* Includes power and timber.
NOTE—General underground expense and surface expense applicable to underground operations are proportioned in the above amounts.

TABLE 2—SUMMARY OF COSTS IN UNITS OF LABOR, POWER, AND SUPPLIES

Year, 1928.
Tons of ore hoisted, 303,301.
Mining method: Shrinkage with pillar support.

	Development	Mining	Total
A. Labor (man-hours per ton):			
Breaking	.....	.....	.642
Timbering	.....	.....	.099
Mucking	.....	.....	.266
Haulage and hoisting	.....	.....	.381
Supervision	.....	.....	.074
General	.....	.....	.073
Total labor	.....	.....	1.535
Average tons per man per shift, including surface labor chargeable to underground operations	.....	.....	5.21
Labor percent of total cost	25.55	39.97	65.52
B. Power and Supplies:			
Explosives (lbs. per ton)—			
25 percent	.....	.128	.128
40 percent	.442	.593	1.035
60 percent	.124	.055	.179
90 percent	.....	.037	.037
Total	.566	.813	1.379
Timber (ft. per ton)—			
Sawed timber (bd. ft.)	.....	.....	1.231
Poles (linear ft.)	.....	.....	.074
Total power (kwh. per ton)	3.436	6.203	9.639
Supplies and power, percent of total cost	12.28	22.20	34.48
C. Percent of Total Cost	37.83	62.17	100.00

TABLE 3—DETAIL OF COSTS PER FOOT FOR TOTAL DEVELOPMENT

	Drifts	Crosscuts	Raises	Shafts
Size of excavation, feet	6 by 7	6 by 7	6 by 8	7 by 17
Timbered, percent	None	None	20	50
Property of rock	Hard	Hard	Hard	Hard
Number of feet	3,372.74	2,808.25	4,322.84	491.96
Total cost per foot	$13.09	$13.09	$18.34	$60.49
A. Labor (cost per ft.):				
Breaking				$4.82
Timbering				.83
Mucking and tramming				4.70
Hoisting				.87
Supervision				.60
Total labor				$11.82
B. Power and Supplies:				
Explosives				$3.01
Timber				.41
Breaking				1.52
Mucking and tramming				.16
Hoisting				.36
Other supplies				.22
Total power and supplies				$5.68
C. Labor, percent of total cost				67.54
Power and supplies, percent of total cost				32.46
Total cost per foot of development				$17.50

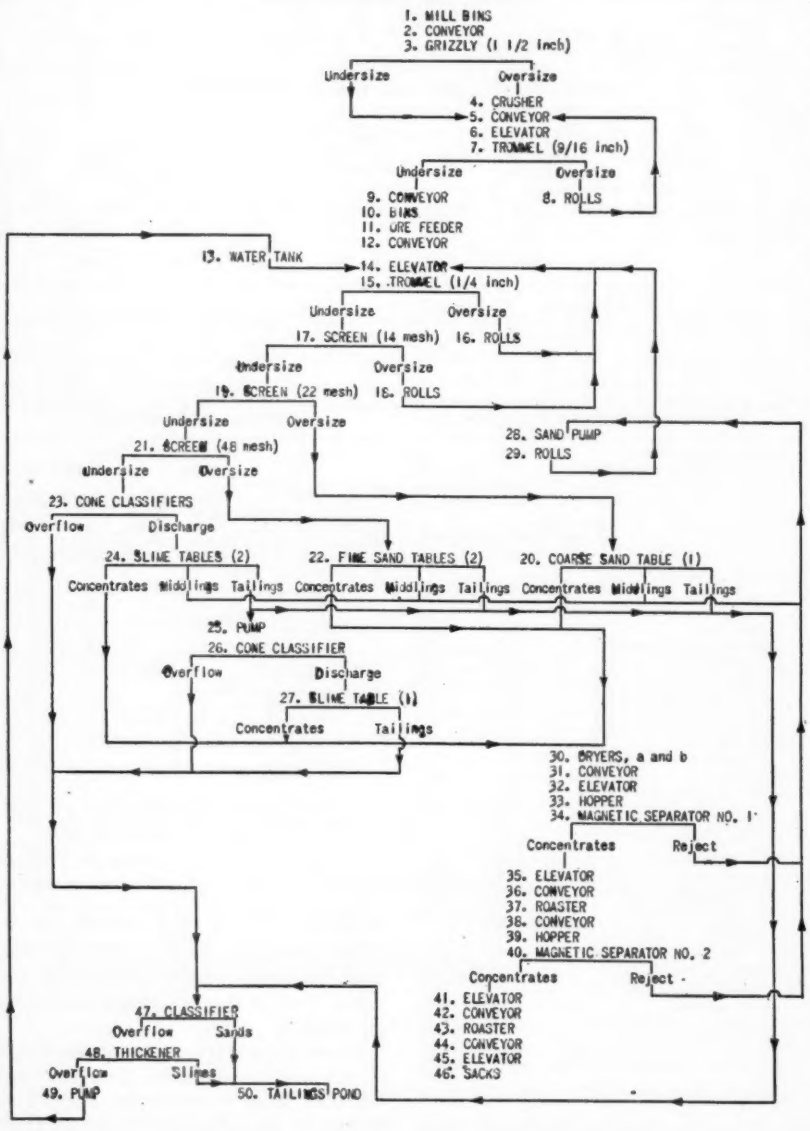


Figure 1—Flow sheet of Mill City concentrator

The following numbers correspond to the numbers on the flow sheet:

1. *Two flat-bottomed wooden bins, combined capacity 500 tons, equipped with eight 24 by 30 inch rack-and-pinion hand-controlled gates.*

2. *Steel apron pan conveyor, variable speed, 24 inches wide, 50-foot centers.*

3. *Grizzly made of taper bar grizzly steel ⅝ by ¾ by 3 inch, 6 feet long, set at a slope of 45° and with 1½-inch opening.*

4. *One 9 by 16 inch Blake-type roll jaw crusher, belt driven, equipped with manganese steel wearing plates.*

5. *Belt conveyor made of 6-ply rubber with 3/16-inch extra cover on wearing side, 24 inches wide on 33-foot centers; speed 280 feet per minute.*

6. *Belt and bucket elevator, with 14-inch belt fitted with 12 by 6 inch buckets spaced 16 inches apart, 48-foot centers, speed 300 feet per minute.*

7. *One 36-inch by 6-foot revolving trommel, 9/16-inch punched perforations, 3/16-inch plate, set on 20° slope; speed 19 revolutions per minute.*

8. *Heavy-type Worthington rolls crushing dry, set to ½ inch, 36 by 15 inch; speed 63 revolutions per minute, chrome steel shells.*

9. *Six-ply rubber belt conveyor, equipped with hand-propelled tripper, belt 12 inches wide on 75-foot centers; speed 300 feet per minute.*

10. *Two 16-foot diameter by 20-foot ore bins made of 3-inch redwood staves, capacity 200 tons each, equipped with 18 by 24 inch rack-and-pinion gates.*

11. *Two right-hand, 14-inch, Hammil ore feeders, now set to deliver at the rate of 6 tons per hour.*

12. *Four-ply cross conveyor belt made of rubber, 12 inches wide, on 30-foot centers; speed 300 feet per minute.*

13. *Water tank, 50,000 gallons capacity, built of 3-inch redwood staves.*

14. *Two belt-and-bucket geared-head elevators, with bottom take-ups, belt 14 inches wide, 8-ply, ⅛-inch extra cover on bucket side. Buckets 12 by 6 inches on 18-inch centers. Belts on 55-foot centers, speed 300 feet per minute.*

15. *Two trommels, 36 inches diameter, 5 feet 10 inches long, covered with No. 23 Tyler Ton-Cap steel-cloth screen with openings approximately ¼-inch long.*

16. *One set of 36 by 16 inch Gates B coarse rolls set to ¼-inch; speed 95 revolutions per minute, chrome steel shells.*

17. *Callow, duplex, 24-inch, traveling belt screen made of 14-inch phosphor-bronze; speed 50 feet per minute.*

18. *One set of 36 by 16 inch Gates B rolls, set fine, chrome steel shells; speed 100 revolutions per minute.*

19. *Callow, duplex, 24-inch, traveling belt screen made of 22-mesh phosphor-bronze; speed 75 feet per minute.*

20. *Two Deister-Overstrom No. 6 tables, one operating, one in reserve.*

21. *Callow, simplex, 24-inch, traveling belt screen, 48-mesh; speed 75 feet per minute.*

22. *Three Deister-Overstrom No. 6 tables, two operating, one in reserve.*

23. *Three 8-foot Callow classifying cones used as thickeners, gooseneck discharge.*

24. *Three Deister-Overstrom slime tables, two operating, one in reserve.*

25. *Centrifugal sand pump, 2-inch, belt-driven, feed-box suction.*

26. *Callow cone classifier, 8-foot, gooseneck discharge.*

27. *One double-deck Deister slime table.*

28. *Centrifugal sand pump, 2-inch, belt-driven, feed box suction.*

29. *One set of 36 by 16 inch Gates B rolls, 105 revolutions per minute, chrome-steel shells.*

30. *(a) Snowco continuous sand dryer, coal-fired; (b) locally designed and built flat-top iron batch dryer, size 6 feet 10 inches by 16 feet, drying surface 4½ feet high, oil-fired.*

31. *Spiral screw conveyor, 6 inches in diameter, 18 feet long.*

32. *Belt-and-bucket elevator, belt 8 inches wide, buckets 6 inches by 4 inches spaced 12 inches apart, centers 16 feet 10 inches; speed 150 feet per minute.*

33. *Sheet-iron hopper attached to magnetic separator, capacity 1,000 pounds, ore fed onto belt uniformly by steel roller.*

34. *Six-pole, Wetherill magnetic separator with 3-inch rubber cross belts.*

Poles	*Ampere turns*	*Amperes*	*Volts*
2	30,000	1.4	120
2	60,000	11.4	120
2	100,000	21.4	120

Motor-generator set for separator No. 1 consists of 10-horsepower, 1,140 revolutions-per-minute, 440-volt alternating-current motor, belted to a 6-kilowatt, 125-volt, 48-ampere, 1,180-r. p. m. generator.

35. *Belt-and-bucket elevator, 8-inch belt and 6 by 4 inch buckets spaced 12 inches apart on 12-foot centers; speed 150 feet per minute.*

36. *Inclined belt conveyor, 8 inches wide; speed 50 feet per minute.*

37. *Locally designed and built continuous roaster, 16 inches outside diameter, 12 inches inside diameter, lined with fire clay, chain-driven, 10 revolutions per minute, fired on discharge end with fuel oil of plus 27° Baume, atomized by air under 20 pounds pressure. Slope of roaster 2 inches per foot.*

38. *Inclined screw conveyor, 6 inches diameter, 20 feet long, equipped with cast-iron flights and operating in a cast-iron trough.*

39. *Sheet-iron hopper attached to magnetic separator, capacity 1,000 pounds, ore fed onto belt uniformly by steel roller.*

40. *Six-pole, Wetherill magnetic separator. Same as separator No. 1:*

Poles	*Ampere turns*	*Amperes*	*Volts*
2	30,000	3.5	120
2	60,000	11.5	120
2	100,000	21.5	120

41. *Belt-and-bucket elevator, 8-inch belt and 6 by 4 inch buckets spaced 12 inches apart on 21-foot centers; speed 150 feet per minute.*

42. *Spiral screw conveyor, 6 inches diameter, operating in wooden trough.*

43. *Two roasters, locally designed and built, consisting of 8-inch pipe 12 feet long, chain-driven, externally-heated by fuel oil of plus 27° Baume atomized by air pressure furnished by motor-driven blower, 6 revolutions per minute, inclined 1 inch per foot, one roaster operating, one in reserve.*

44. *Spiral screw conveyor, 6 inches diameter, 20 feet long.*

45. *Chain-and-bucket elevator, 15-foot centers; speed 150 feet per minute.*

46. *Burlap sacks canvas-lined; size empty, 14 by 24 inches.*

47. *Akins classifier, 54 inches by 10 feet, slope 2 inches per foot.*

48. *Dorr thickener, 20 feet in diameter, 10 feet deep.*

49. *Belt-driven triplex plunger pump, 8 by 10 inches.*

50. *Tailings pond.*

Concentrating Tungsten Ore at Nevada-Massachusetts Mill

By Ott F. Heizer†

THIS paper describing the practice at the tungsten concentrator of the Nevada-Massachusetts Co., Inc., at Mill City, Nev., is one of a series being prepared by the Bureau of Mines on milling practices, methods, and costs in the United States.

The ore, which contains about 1.10 percent of scheelite ($CaWO_4$), is concentrated on tables and by means of a magnetic separator and roasters. A product containing 70.43 tungsten trioxide is shipped. The plant was designed for a capacity of 100 tons per 24 hours, but at present 142 tons of ore are milled per day.

The author acknowledges the assistance of William O. Vanderburg, associate mining engineer, U. S. Bureau of Mines, in preparing this paper.

The mill and the mines of the Nevada-Massachusetts Co. are situated in Pershing County, Nev., 8 miles northwest of Mill City—a station on the main line of the Southern Pacific Railroad. An automobile road connects the property with the railroad. Supplies and concentrate are hauled by trucks. The property, situated on the rolling east slopes of the Eugene Mountains, has an elevation of about 5,500 ft. above sea level. The climate is semiarid; operations are carried on throughout the year.

Ore Treated

At present the ore is derived from two mines—the Stank, which is 730 ft. deep, and the Humboldt, which has reached a depth of 620 ft. and is now being deepened. The mines are developed through inclined shafts; the shrinkage system of mining is employed.

The economic mineral in the Mill City ores is scheelite: it occurs unevenly disseminated as small white grains barely larger than grains of wheat in a gangue composed principally of garnet, quartz, epidote, calcite, and pyrite. A total of 17 minerals has been identified in the ore, but their distribution is very erratic. Such gangue minerals as garnet, zoisite, epidote, vesuvianite, clinozoisite, and quartz are harder than the scheelite and in grinding they pulverize this last mineral, which is friable and readily slimes.

The main aim in milling is to crush the ore to liberate the scheelite grains with a minimum amount of sliming. Rolls are used to give reduction in stages, which results in the recovery of scheelite in coarser form with a minimum of slime loss. The use of stamps or ball mills for crushing is not conducive to a good recovery. Some of the ore is extremely hard, whereas in other places it is of medium hardness.

About 95 percent of the ore is broken fine enough in blasting to pass through the ore pocket grizzlies with 8-in. openings. At present the mine ore averages about 1.10 percent of scheelite or about 0.9 percent of tungsten trioxide.

Tungsten concentrates, which are used in the manufacture of alloy steels, is subject to rigid requirements as to impurities. The Mill City concentrates are used principally in the steel industry and are sold under a quality guarantee similar to the following:

Tungsten trioxide, percent	65-70
Tin, percent, maximum	Trace
Copper, percent, maximum	0.05
Sulphur, percent, maximum	0.75
Phosphorus, percent, maximum	0.05
Arsenic, Antimony, Bismuth	percent, not to exceed 0.035 each.

All of the above undesirable elements occur in the minerals of the Mill City ores and are eliminated during the concentrating process. The scheelite concentrates carry from 4 to 6 ounces of silver and a trace of gold per ton, but no effort is made to recover the precious metals.

History of the Concentrator

The mill was erected in the latter part of 1918, under the stimulus of the demand for tungsten alloys in the manufacture of munitions for war purposes. Due to the inability to compete with the tungsten ores from foreign sources, which were thrown on the market after the Armistice, the mines and mill were closed after running only a short time.

In September, 1922, a tariff of 45 cents per pound was placed on tungsten, and in 1924 operations at Mill City were resumed; they have been continuous to this time.

With the exception of the installation of roasting equipment when sulphide ores were encountered, the mill flow sheet is essentially the same as when first designed.

General Flow Sheet

Figure 1 shows the mill flow sheet. The treatment of the scheelite ore is briefly as follows:

1. Breaking, crushing, screening, and classifying.
2. Tabling, producing a bulk concentrate; concentration begins at 14 mesh.
3. Magnetic separation of garnet and epidote from scheelite and pyrite.
4. Roasting to magnetize pyrite.
5. Magnetic separation of iron from calcine.
6. Final complete or "sweet" roast to drive off remaining sulphur, producing shipping concentrates.

The average grade of the shipping concentrates are above 70 percent tungsten trioxide; and a single carload lot has assayed as high as 76.88 percent.

The mill site is on a hillside location. The ore from the mines is delivered to the upper end of the mill in cars hauled by a gasoline locomotive and dumped into two flat-bottomed bins having a combined capacity of 500 tons.

Breaking

Eight 24 by 30-in. rack-and-pinion gates control the discharge of ore from the bins onto a 24-in. variable-speed steel apron conveyor. The conveyor discharges on a grizzly with 1½-in. openings, the oversize going to a 9 by 16-in. Blake-type roll-jaw crusher with manganese steel wearing plates. The average life of the wearing plates is about 60 days.

Crushing and Screening

The broken ore from the Blake crusher and the undersize from the grizzly are discharged onto a 24-in. belt conveyor and into a belt and bucket elevator feeding a trommel with 9/16-in. punched holes. The undersize from the trommel falls on a 12-in. belt conveyor equipped with hand-propelled tripper, and the oversize goes to a pair of 36 by 15-in., 63 revolutions per minute, heavy-duty rolls operating in closed circuit with the trommel. The conveyor discharges through the tripper into either of two cylindrical redwood-stave bins, each holding 200 tons. The concentrator is fed from the bins through either of two Hammil ore-feeders at the rate of 6 tons per hour. The ore is carried on a 12-inch cross-conveyor belt to a belt-and-bucket elevator where water is

* Reprinted from U. S. Bureau of Mines Information Circular 6280.

† Consulting engineer, U. S. Bureau of Mines.

added before the ore is elevated to a trommel covered with No. 23 Tyler Ton-Cap steel screen, which has openings approximately ⅛-in. wide and ¼-in. long; the percentage of openings is 38. The oversize from this trommel goes to a set of 36 by 16-in., 95 revolutions per minute, Gates B coarse rolls, set to ¼-in., which operate in closed circuit with the trommel. The undersize passes onto a 24-in., 14-mesh, Callow duplex traveling belt screen of phosphor-bronze. The oversize from the screen passes to a set of 36 by 16-in., 100 revolutions per minute, Gates B rolls, set fine, and thence back into the elevator. The undersize from the 14-mesh screen passes to a 22-mesh, Callow duplex traveling screen of phosphor-bronze, the oversize from which furnishes the coarse table feed. The undersize from the 22-mesh screen is again screened by a 48-mesh Callow simplex traveling belt screen of phosphor-bronze. The oversize from the 48-mesh screen is divided between two Deister-Overstrom fine sand tables and the undersize, after thickening in three 8-ft. Callow cones, between two Deister-Overstrom slime tables.

Gravity Concentration

Each of the five tables mentioned above yields three products—concentrates, middlings, and tailings. The concentrates from the tables go to the dryers, the middlings to a set of 36 by 16-in. Gates B rolls, running at 105 revolutions per minute, set close, and the tailings to the dewatering plant, except part of the tailings from the two slime tables which handle the undersize from the 48-mesh screen. The tailings that do not go to the dewatering plant are pumped into an 8-ft. Callow cone. The gooseneck discharge from the Callow cone is treated on a double-deck Deister slime table with vibratory head motion. The concentrates from the double deck slime table go to the dryers and the tailings to the dewatering plant.

Roasting and Magnetic Separation

The table concentrates are dried by two dryers, one of which is a coal-fired, continuous Snowco sand dryer, and the other a locally designed flat-top bath dryer fired by fuel oil atomized by air under a pressure of 20 pounds. With the last-named dryer a batch of 300 pounds is dried in about 30 minutes. The two dryers are necessary to handle all the product. Concentrates are shoveled by hand into the dryers from a shoveling platform. The dried concentrates are carried by a conveyor and a bucket elevator in a hopper from which they are fed to a six-pole Wetherill magnetic separator which removes the faintly magnetic garnet and epidote. A strong magnetic field is necessary. The magnets are wound for 30,000, 60,000, and 100,000 ampere turns. Although there is an appreciable difference in the specific gravity of the three principal minerals in bulk concentrates (scheelite, specific gravity, 6.00; pyrite, specific gravity, 4.9 to 5.0; garnet, specific gravity, 4.0 to 4.4), it is practically impossible to eliminate the pyrite and garnet by tabling, even when close sizing is employed, without incurring a heavy loss of scheelite.

The concentrates from the first magnetic separator, with the garnet and epidote removed, are roasted in a 16-in. outside-diameter and 12-in. inside-diameter iron furnace 12 ft. long, placed on a slope of 2 in. per foot. This roaster was designed and built locally. The interior of the pipe is lined with fire clay. It is chain driven and rotates at about 10 revolutions per minute. The roaster is internally fired at the discharge end with fuel oil of plus 27° Baumé, atomized by air under 20 pounds pressure. Only enough oil is used to ignite the sulphur in the ore; oil consumption is 1 gallon per hour. The concentrates are fed by a screw feeder made out of a 2-in. coal auger. The fumes and dust entering the stack on the roaster pass through a 36-in. blower to a 30-in. diameter by 8-ft. Cyclone dust precipitator.

The concentrates fed into the roaster contain about half scheelite and half pyrite. The pyrite is rendered magnetic by a short roast (about 5 minutes) in the presence of air. A chemical change analagous to the following takes place:

$$n(FeS_2) + (2n-2)O = Fe_nS_{n+1} + (n-1)SO_2.$$

The exact sulphide which is formed varies with the length of the roast. The artificial magnetic sulphide is formed only on the surface of each grain, and the kernel remains unaltered pyrite (FeS_2), providing the roast is short. If the roast is carried too far, hematite (Fe_2O_3) results which is only faintly magnetic. It is not feasible to roast the garnet with the pyrite as the garnet would agglomerate and form crusts and thus prevent magnetic separation. Dust losses in roasting are not important, as the scheelite remains unaltered and retains its original weight.

The calcine discharges into a spiral screw conveyor 20 ft. long and 6 in. in diameter with cast-iron flights and a cast-iron trough. The product cools on the way to the second magnetic separator, where the magnetized iron sulphide is removed. This magnetic separator is also a Wetherill of the same type as the one which removes the garnet and epidote. The reject from both separators is returned to the middling rolls and over the tables. The garnet reject from the No. 1 magnetic separator is eliminated by passing into the slime. The pyrite reject from the No. 2 magnetic separator is rendered porous by roasting, thus lowering its specific gravity and making it amenable to separation from the scheelite by table concentration when returned to the mill circuit.

The concentrates from the second magnetic separator are subjected to a dead or complete roast in an externally-fired, chain-driven roaster 8 in. in diameter and 12 ft. long. This roaster was also designed and built locally. It rotates at about six revolutions per minute and is inclined 1 in. to the foot. Fuel oil atomized by air is used for fuel. Oil consumption is 1¼ gallons per hour. The dead roast removes practically all the remaining sulphur, producing the shipping concentrates, which are packed in double canvas and burlap sacks holding about 120 pounds each. A carload shipment averages about 35 tons.

Dewatering and Disposal of Tailings

The tailings from the tables is conveyed by a wooden box launder to a 54-in. by 10-ft. Akins classifier, set to a slope of 2 in. to the foot. The sand is sent to the tailing pond and the overflow containing the slime goes to a Dorr thickener, 20 ft. in diameter and 10 ft. deep. The water recovered in the thickener overflow amounts to about 75 percent of the mill water used. The slime product of the thickener is sent to the tailings pond with the sand. The greater percentage of the mill loss occurs in the slime product, and all the tailing is impounded with a view to some day recovering the scheelite. The tailings are disposed of by gravity flow from the dewatering plant. Unlimited tailings-disposal ground is available and earth dams are constructed around the lower end of the pond to hold the tailings in one place. The dams are raised from time to time as the pond is filled.

Six tons of water is in the mill circuit for each ton of ore. The water from the thickener overflow is pumped back by a triplex plunger pump into the mill supply tank of 50,000 gallons capacity.

Conveying

Due to the high specific gravity of the pulp and the abrasive action of the garnet in the ores, special consideration was given to the construction of the mill launders. The tailings launder is made of wood, lined on the bottom with ½ by 4-in. strap iron; the slope is 2 in. per foot. The steeply inclined launders feeding the tables are made of wood lined with armorite, which is a high-quality rubber vulcanized to a fiber or sheet-steel base.

The 2-in. centrifugal pumps for handling pulp have white cast-iron casings, the wearing qualities of which are equal to the manganese steel casings formerly used, and the cost is about one-third.

Sampling

Mill operations are controlled not by assay but by panning, which is a very reliable method in experienced hands because scheelite pans as readily as gold. A rapid reliable method has not been worked out for assaying tungsten ores similar to those at Mill City. With the standard methods now in use there is a wide variation in results unless extreme care is exercised in manipulation. Taking into consideration (1) the uncertainties incident to the determination of tungstic acid, (2) the time required to obtain reliable assays, and (3) the cost, the best results on the Mill City ores are obtained by panning.

A specific-gravity method for approximate analyses has been used on other tungsten ores. This method is feasible when the gangue minerals are of low specific gravity in comparison with tungsten and are uniformly distributed in the ore. However, this method is not applicable to the Mill City ores because of the amount of pyrite and garnet present and the wide variations in their distribution.

Water Supply

Water for milling purposes is obtained from the mines. The domestic water supply is obtained from a well 56 ft. deep, sunk in the valley to the east of the property. This water is pumped into a tank by a 2-in. centrifugal pump on the well casing, and is relayed to a 100,000 gallon tank in two lifts by two 7 by 10-in. vertical triplex pumps each belt-driven by a 50-horsepower, 870 revolutions per minute, 440-volt motor. The centrifugal pump is direct-connected to a 10-horsepower, 1,700 revolutions per minute, 440-volt, alternating-current motor. The total lift is 776 ft. and the total length of the 6-in. redwood stave pipe is 21,150 ft. The capacity of the plant is 250 gallons per minute. The cost of pumping is about 20 cents per thousand gallons. The pumping installation was financed jointly by the two companies operating in 1918. The total cost of construction and equipment of the water plant was about $48,000.

Power

Power is purchased from a power company at a cost of about 2 cents per kilowatt-hour. The electricity is generated at the Lahontan Dam of the Truckee-Carson Irrigation project, 140 miles distant. The power company had a line to Oreana, 42 miles from the mine, and from this point a transmission line was run to the mines. This line was built by the mining companies at a cost of $65,000. Electricity is transmitted at 60,000 volts and stepped down to 6,000 at the mine substation for distribution around the property. It is further transformed to 440 volts for all motors.

Labor

A crew of 12 men working on three shifts is required to operate the mill.

Concentrator Recovery

The average mill recovery of scheelite is estimated at about 80 percent. A partial chemical analysis of an average carload of scheelite concentrates is as follows:

	Percent
Tungstic acid	71.43
Sulphur	0.43
Copper	0.03
Arsenic	None
Antimony	None
Bismuth	0.12
Tin	None
Molybdenum	0.13

A partial analysis of the tungsten concentrates before roasting is as follows:

	Percent
Tungstic acid	42.55
Sulphur	17.76
Copper	4.20
Arsenic	0.004
Antimony	0.11
Molybdenum	0.15
	Oz. per ton
Gold	Trace
Silver	4.80

A partial analysis of the roasted artificial sulphide is as follows:

	Percent
Tungstic acid	4.51
Sulphur	33.54
	Oz. per ton
Gold	0.01
Silver	6.19

METALLURGICAL DATA

	Year 1928
Tons of ore milled	40,924
Days operated	362
Hours operated per day (from Jan. 1 to July 15)	16
Hours operated per day (from July 15 to Dec. 31)	24
Average hours operated per day	19.67
Average ore milled per day, tons	113
Total scheelite concentrates, tons	450.2
Total scheelite concentrates, pounds	900,410
Total tungstic acid (WO_3), pounds	634,159
Total tungstic acid (WO_3), units of 20 pounds	31,708
Total concentrates per 24 hours, pounds	2,487.3
Total tungstic acid (WO_3), per 24 hours, pounds	1,751.8
Total tungstic acid (WO_3), per 24 hours, units of 20 pounds	87.59
Tungstic acid (WO_3), recovered per ton of ore, pounds	15.5
Tungstic acid (WO_3), recovered per ton ore, units of 20 pounds	0.775
Recovery of scheelite, percent (estimated)	80
Ratio of concentration	91.1
Average assay of concentrates, percent tungstic acid	70.43
Net water consumption per ton of ore, gallons	352

SUMMARY OF COSTS

Gravity and magetic separation
Tons of ore treated: 40,924

Year 1928
Pounds of concentrates produced: 900,410

	Labor	Power	Supplies	Total
Breaking and crushing to 9/16 inch.	$0.069	$0.080	$0.013	$0.162
Crushing, screening, and conveying	.117	.127	.062	.306
Tabling	.123	.033	.004	.160
Magnetic separation and roasting	.098	.046	.082	.226
Dewatering and pumping	.053	.014	.001	.068
Superintendence	.066	....	....	.066
Miscellaneous	.047	....	.211	.258
Total	$0.573	$0.300	$0.373	$1.246

Note: Above costs are direct costs only.

SUMMARY OF COSTS IN UNITS OF LABOR, POWER, AND SUPPLIES

Gravity and magnetic concentration
Tons of ore treated: 40,924

Year 1928
Pounds of concentrates produced: 900,410

A—Labor (Tons per 8-hour man-shift)	Tons
Breaking and crushing to 9/16-inch	75.9
Crushing, conveying and screening	44.8
Tabling	42.6
Magnetic separation and roasting	51.8
Superintendence	111.2
Dewatering	101.8
General	98.9
Tons per 8-hour manshift, total labor	9.4

B—Power (kw.h. per ton of mine ore)

	KW.H.	Percent of total power
Breaking and crushing to 9/16-inch	4.00	26.7
Crushing and screening	5.00	33.3
Tabling	1.66	11.1
Magnetic separation and roasting	2.31	15.4
Dewatering	0.69	4.6
Conveying and elevating	1.34	8.9
Total	15.00	100.0

SEPARATION OF QUARTZ AND FELDSPAR BY FLOTATION

Quartz and feldspar constitute a large part of the earth's crust and also are the most widely distributed of all minerals, says the Bureau of Mines. The uses of these minerals are almost innumerable and when pure, they are much sought for and command a relatively high price.

If a commercially feasible process is devised for the separation of quartz and feldspar it will have a direct bearing on the beneficiation of the non-ferrous base metal ores, due to the almost universal presence of quartz and feldspar as a objectionable dilutent in such ores.

In order to assist the mining industry to devise a commercially feasible process for the separation of quartz and feldspar, the Intermountain Experiment Station of the Bureau of Mines, in cooperation with the Department of Mining and Metallurgical Research of the University of Utah, Salt Lake City, Utah, has made a study of the problem, and as a result of the work that has been done, it is believed that a method has been devised which will meet the requirements. Moreover, in connection with the work, considerable data have been obtained which will be a distinct contribution to our present knowledge of flotation.

In connection with the work done by the Bureau of Mines, it was found that carefully controlled minute amounts of certain reagents would cause the feldspar particles to float and did not affect the quartz similarly. By this treatment 90 per cent of the feldspar of a quartz-feldspar ore was floated and this flotation product contained more than 90 per cent feldspar. The necessary quantities of the reagents range from a few hundredths to one-half pound per ton of ore.

Further work is to be done on this problem, and later the results will be published in the form of a Bureau of Mines technical paper.

FLUORSPAR at Rosiclare, Illinois—*methods and cost of mining*

By Edwin C. Reeder†

THE mining methods described in this paper are those used in one of the large mines producing fluorspar in the Kentucky-Illinois fluorspar field, located in southern Illinois and western Kentucky on the Ohio River. The occurrence of ore and the methods of mining are similar to those in other mines in the district, therefore information regarding methods and the results obtained should be of interest. Improvements in methods have been made as experience developed the need of them.

The mine is situated at Rosiclare, Ill., on the Illinois Central Railroad, and shipments are also made by barge on the Ohio River.

History of District

The presence of fluorspar and galena in this field was known nearly 100 years ago, but no mining was attempted until 1842.

In that year fluorspar and galena were discovered near the site of the present Rosiclare mine, and development of the deposit began.

Up to 1905 Hardin County, Ill., was a small but consistent producer. Prior to 1893 almost all the shipments were of lead ore, as the market for fluorspar was small and the fluorspar had little value. With the advent of the basic open-hearth steel furnace and real demand for fluorspar began, and with the growth of the steel industry there has grown a market for fluorspar, the bulk of which is used for flux in the open-hearth furnace.

Geology

The geology of the fluorspar deposits is comparatively simple, and the veins usually outcrop at the surface.

The underlying rocks are a series of horizontal or slightly inclined beds of limestone, sandstone, and shale of Chester (Upper Mississippian) age, which have been extensively faulted and moved. There are a number of major faults that can be traced for long distances and are intersected by numerous small faults.

The faults are almost without exception of the normal or gravity type.

In a number of places dikes and sills of igneous rock cut the sediments, but none have as yet been exposed in the mine workings down to the lowest depth thus far opened.

Some of these fault fissures are mineralized with vein fillings of calcite, fluorspar, galena, and spalerite, with calcite the commonest material. In the workable veins the fluorspar replaces the calcite either wholly or partially. There are a few areas in the district in which fluorspar has replaced beds of limestone overlain by impervious strata, forming tabular or bedded deposits tributary to fissures.

Many of the vein deposits terminate beneath a mantle of clay soil resulting from decomposition of limestone. In such cases insoluble lumps and grains of fluorspar are distributed through the clay in the form of a gravel deposit.

The vein in the mine we are about to describe is an extension of the Rosiclare fissure vein, with a general north and south strike and a

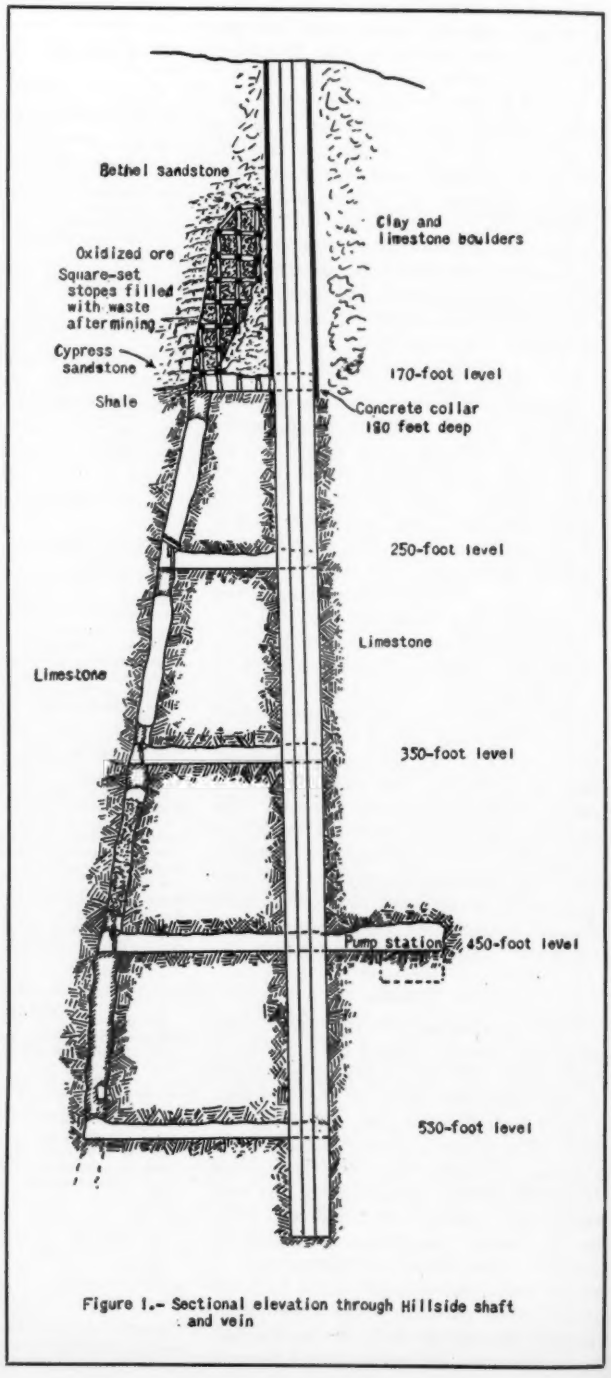


Figure 1.- Sectional elevation through Hillside shaft and vein

* Reprinted from U. S. Bureau of Mines Information Circular 6294.

† Consulting engineer, U. S. Bureau of Mines, and general manager of mine described.

dip almost vertical, though usually it dips to the west at a high angle.

At the surface the hanging wall is sandstone underlain by a bed of shale under which is a series of limestones. (See *Figure 1.*) The footwall is limestone, and both walls below the shale bed mentioned above are solid and strong and stand indefinitely when exposed to the air. The vein has been subjected to several post-mineral movements, marked by slicken-sides and brecciated areas in the ore. The vertical movement seems to have been as much as 125 ft., the hanging-wall side having dropped, and the horizontal movement is nearly 500 ft. to the south.

The vein in places attains considerable width, the maximum being 34 ft., with widths of 18 to 20 ft. common and the average about 12 ft. The length of the ore shoot in this mine is 1,900 ft. The ore body is practically continuous for its entire length and is usually mined out completely from level to level.

Methods of Exploration and Prospecting

As the dip of the vein is quite uniform, the ore shoots can be projected from one level to the next with sufficient accuracy.

It is usual to prospect by drifting and crosscuts, winzes, and raises.

Diamond drilling is used to a limited extent both from surface and underground. Surface diamond drilling is done to locate other veins and fissures, and usually inclined holes at 45° inclination are drilled. Underground diamond-drill holes are driven to get information as to parallel veins. They are usually horizontal and have been drilled to a depth of 800 ft. Horizontal holes, in the limestones particularly, deflect badly on striking hard areas or flint bands, and unless the hole is surveyed the operators are in the dark as to where the hole actually is.

Drifting and crosscutting are done to open up new territory or to check up on diamond-drill discoveries.

Sampling and Estimating Tonnage

It is not usual to attempt any sampling of underground works, and it is not difficult to estimate the grade of the ore by the eye. An ore-reserve estimate is made annually, and as the ore is of comparatively uniform grade the estimate is made on tonnage only. Blocks of ground opened by drifts, on two sides, and a raise or stope on the other are considered as a uniform block, and the area of each drift and the distance between are used in calculating the cubic contents. Drifts in ore are usually carried the full width of the ore, and a figure of 10 cu. ft. per ton of 2,000 pounds is used for estimating ore in place. Stopes are measured once a month, and areas of horizontal section are computed.

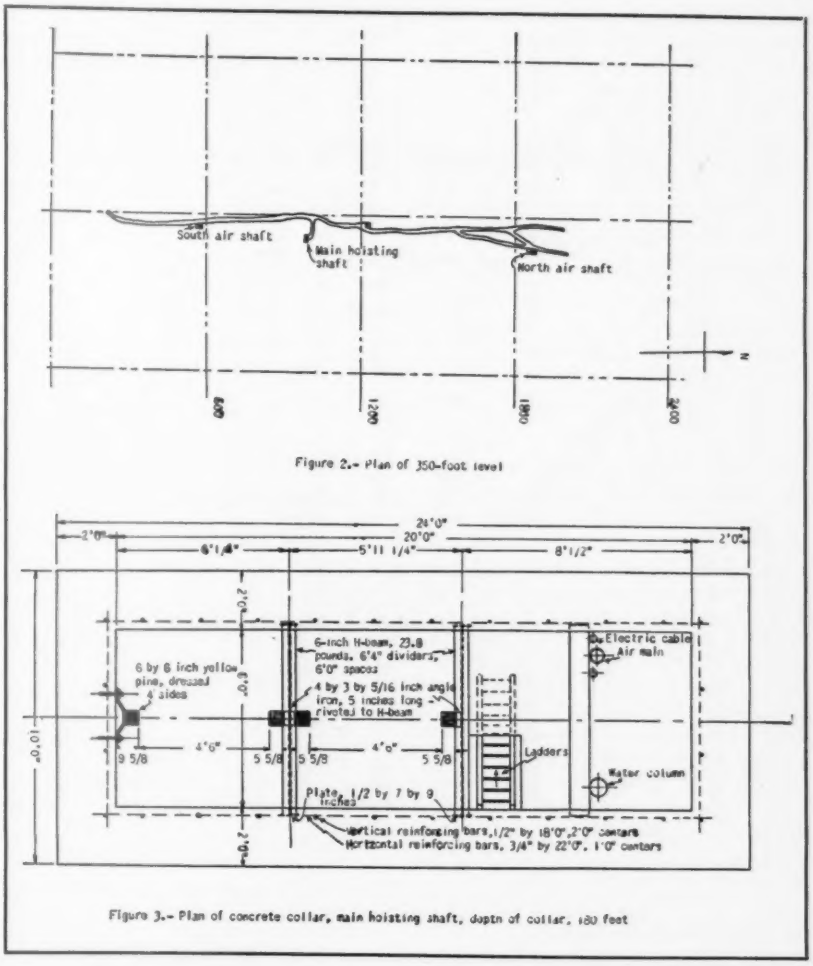


Figure 2.- Plan of 350-foot level

Figure 3.- Plan of concrete collar, main hoisting shaft, depth of collar, 180 feet

Methods of Development and Mining

The mine is opened by means of one vertical hoisting shaft of four compartments and is producing from five levels at the rate of about 5,000 tons per month. The mine is operated on a single-shift basis; and all ore is hoisted through the main shaft, which is located close to the mill so that the skip dumps directly into the mill bin at the top of the headframe.

The main vertical shaft, sunk in the footwall, is about midway of the ore body, and ore comes to the shaft from both sides (*Figure 2*).

There are two vertical air shafts, the one at the north end having two compartments 5½ by 6 ft. and a depth of 400 ft. This shaft has a cage road and ladderway and is equipped with an electric hoist for handling men and supplies, but no ore is hoisted. The south air shaft is a single compartment opening 5 ft. by 7 ft., and extending to the 250 level; it is equipped with ladders and is used for ventilation and as an escapeway for emergencies.

The main shaft (*Figure 3*) is 6 by 20 ft. in inside measurement and contains two hoisting compartments 5½ by 6 ft., a ladderway and pipe compartment 8 by 6 ft., and at present is 600 ft. deep. The long axis of the shaft is east and west and approximately at right angles to the vein, which is about 70 ft. from the shaft.

The west hoisting compartment is equipped with an ore skip, and a cage occupies the other hoisting compartment.

The cage is weighted with concrete blocks to counterbalance the weight of the skip.

The skip holds 3 tons of ore, or 54 cu. ft., and is loaded from pockets at the different levels. The cage is a single-deck affair, and is used for hoisting waste in cars as well as men and supplies. The cage holds 14 men without crowding. This shaft is lined with concrete 2 ft. thick, reinforced with steel bars, extending from the surface to the solid limestone 180 ft. below. No timbers are used in the shaft below the concrete collar with the exception of the guides and the dividers.

The first level is the 170, the next the 250, and then 350, 450 and 550. The 350, 450 and 550 levels have ore pockets

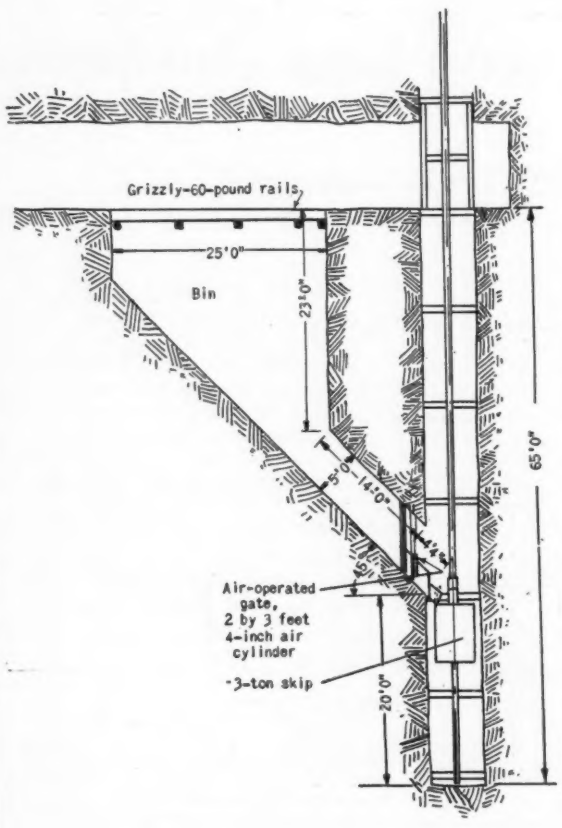


Figure 4.- Typical ore pocket, 450-foot level

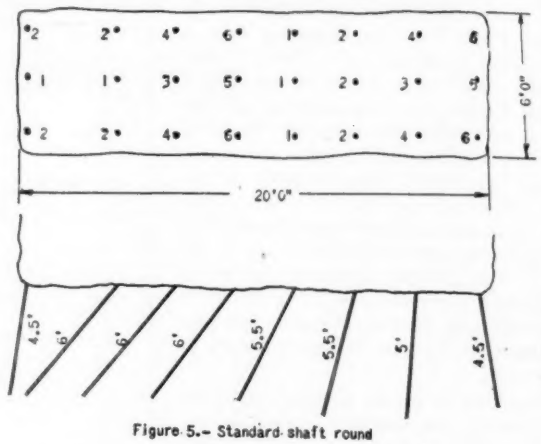


Figure 5.- Standard shaft round

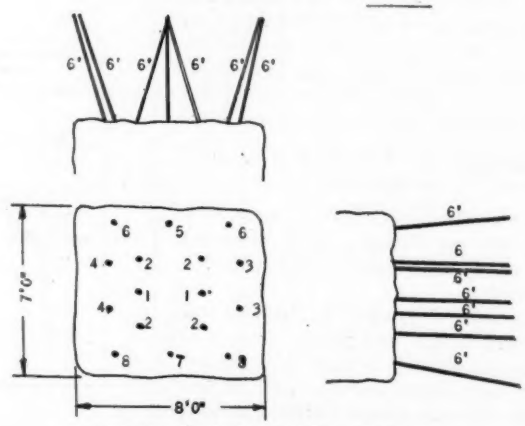


Figure 6.- Standard V-cut drift round in ore

with air-operated gates and chutes for loading the skip (*Figure* 4). All ore from the upper levels is dumped into raises and passed to lower levels, where it is trammed to the shaft for hoisting.

Shaft sinking is done under a rock pentice by a crew of local men, usually three on a shift, working two eight-hour shifts. A sinking hoist is set up in the station at the lowest level, and the broken rock from the shaft sinking is hoisted in 10-cu. ft. buckets and dumped into mine cars, which are run on the cage and taken to the surface or dumped into empty stopes.

All drilling is done with 57-pound jackhammers, and 24 to 27 holes 5½ ft. deep are required to break a round, which will advance about 4 ft. (*Figure 5*). It is usual to drill and blast the cut in one end of the shaft and then to break the bench with the next round. No. 6 electric exploders, 1-5 delay connected to a 220-volt lighting circuit, and 35 percent gelatin dynamite are used to break the ground.

Drifts and Crosscuts

All drifts and crosscuts are nominally 7 ft. high by 8 ft. wide, and track is carried on a grade of 0.5 percent in favor of the loads. Whenever possible drifting and crosscutting are contracted, and below the 170-ft. level no timber is required except for ore chutes and bins. The machines used for drifting work are all of the one-man type, either the mounted jackhammer or light drifter being satisfactory. Steel used is 1-in. hollow hexagon, with cross bit made with 5° and 14° taper.

A standard wedge cut is used, and 16 holes are usually necessary to pull a full round which will break about 4 ft. (*Figure 6*).

This round does the best all-around work, and the cut holes are loaded with six sticks each and the other holes with five sticks each of 1¼ x 8—35 percent ammonia gelatin. When drifting in spar it will frequently not require as many holes to pull a round, and then again when the ground is calcite with limestone horses or boulders it may take a few more holes.

Each miner takes down his own steel. The dull steels are carried to the shaft station, and the skip tender takes them up to the surface.

Very little trouble is experienced with drill steel, the principal trouble being due to steel breakage.

Raises

Standard raises are 5 by 7 ft. in area and are driven on contract. A hand-rotated "dry" stoper using 1-in. solid hexagon steel is the machine used for drilling. Raises are usually driven by one miner, and if the raise goes up over 50 ft. he is given a helper. No timbering is required, and the miner puts in his own working poles and scaffold planks. A wedge cut is used, and a round usually breaks 3½ to 4 ft. After a raise is up about three or four rounds the timbermen put in two stulls over the level and build a bin between so that no shoveling is required.

All material is pulled up the raises by a hand line, and the line of working poles on each end of the raise forms the only way of getting up and down until the raise is finished. Naturally anybody who is not able to "coon" his way up these poles has no business in a raise.

Stopes

When opening a new stope the bin raises are spaced at 25-ft. centers and are driven high enough to allow a sub-

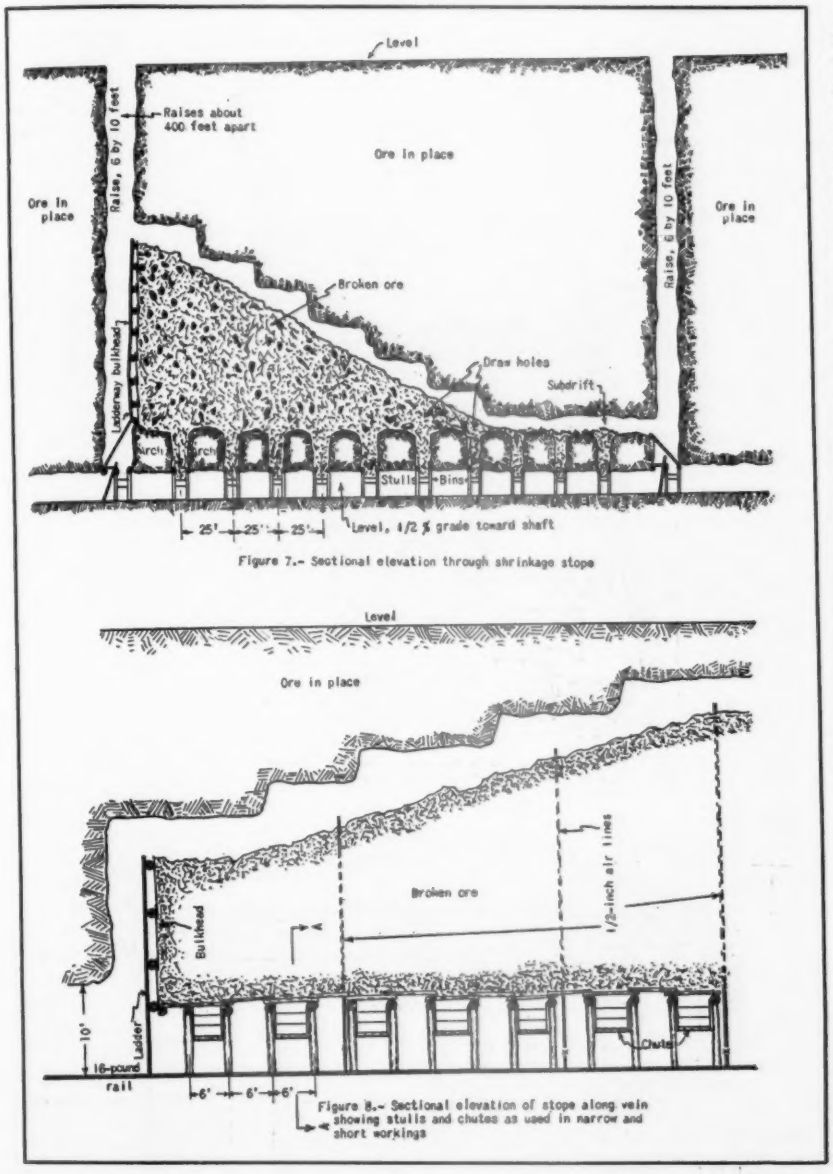


Figure 7.- Sectional elevation through shrinkage stope

Figure 8.- Sectional elevation of stope along vein showing stulls and chutes as used in narrow and short workings

drift to be started over the level pillar to connect the tops of the raises. These subdrifts are slabbed out to the full width of the vein, and from then on stoping upward begins.

The straight shrinkage system is used, and stoping is started after the drift has advanced in ore a sufficient distance to clear the way so that the chute raises can be put up and the bins built in them.

There is no set length for stopes, and they may vary from 100 ft. to several hundred feet in length, depending on several factors, such as the location of through raises to the level above, the position of a pinch in the vein or a horse of rock, or how badly the ore is needed. The ideal condition is one in which the drift is kept far enough ahead of the stope so that a long stope can be carried up and numerous bulkheads can be avoided, better ventilation will be possible, and the slope of the ore fill in the stope will not become too steep. The sketch (*Figure 7*) shows the typical layout in wide ore. The back of the stope is carried in steps, the faces of which are advanced from one end of the stope to the other; usually several faces are worked at once. Sometimes when a raise is available or a high step, instead of using the customary upper holes, jackhammers are employed and long flat holes are drilled. Often it is possible to put in flat holes 12 or 15 ft. deep, and a lot of ore can be broken cheaply and quickly. When the stopes are very wide this system of flat holes is very effective and produces much less fines in the broken ore than the vertical-hole method of blasting.

As the stope is carried upward the increase in volume of the broken ore makes available considerable tonnage, which must be drawn off every day to give the miners room to work. The volume of the broken ore is nearly double that of the ore in place, and the top of the ore pile is kept about 6 or 7 ft. below the back, which gives the miners room to drill; at the same time, they can work all loose ground and take it down before it drops and hurts some one. Arches (*Figure 7*) are usually left 1 ft. deep for each foot in width up to a depth of 15 ft., which seems to be deep enough to carry the load at the widest places (34 ft.). Where the ore body is very narrow and short, the broken ore is carried on stull timbers instead of arches, as shown in *Figures 8* and *9*. As the walls are very strong and solid the floor and stope arches have no side pressure to withstand, and when the stopes are emptied of their content of broken ore the arches are mined out and dropped into the stope below. When drawing out the broken ore from a completed stope it is customary to trim down the walls, and large slabs of limestone on the walls are kept from falling by heading light stulls against them, which secures them until the stope is emptied and abandoned. In this system of mining it is easy to leave areas of barren ground and go around them.

No filling is used in the shrinkage stopes, and these open stopes, sometimes 200 ft. high or more, stand open for years.

Square-Set Stopes

From the surface down to the 170 level the ground is oxidized and leached, and practically all calcite in the vein has disappeared leaving the spar with a gangue of stiff red clay. The walls of the vein have also largely disappeared leaving boulders of rock imbedded in the clay. The method of mining this level is that of square sets and fill.

The ore body is quite wide, measuring from 20 to over 40 ft. in width. The main drift is in the footwall back far enough to be safe from the crushing of the soft moving ground. Short crosscuts reach the ore, and stopes are carried across the ore to the hanging wall. These stopes are usually carried two sets long and the full width of the ore and are timbered with round timbers framed to a standard size of 6-ft. centers on the caps and girts and 6 ft. 4 in. for the posts. The logs from which the sets are framed measure 10 to 12 in. in diameter and are hardwood, grown locally, being mostly red and white oak and hickory. Lagging is either of 4-in. round poles or split poles 6 to 8 in. in diameter.

Filling is obtained from the walls from short crosscuts, and all open sets are filled up tight as fast as mined out. Usually one set is left open for an ore

pass and another for a manway, and the timbered stopes are carried up in the ore a distance 11 to 12 floors high or about 70 ft. When the stope is mined out and filled with waste the miners begin at the sill floor of another one alongside the old stope.

In driving crosscuts in the walls for filling, the broken material is handled by compressed-air tugger hoists which drag the waste into the stope.

About 25 percent of all ore hoisted comes from the square-set stopes.

Underground Transportation

All ore hoisted to the surface is loaded into the skip from pockets on the 350, 450 and 550 levels. Ore from levels above the 350 level is sent down by ore passes and trammed to the skip pocket. All ore is trammed by hand, as tramming distances are short, the longest being about 900 ft., and the average tram about 500 ft. All tracks are 18-in. gauge and laid with 16-pound rail, and all ore cars are 22-cu. ft. capacity, rotary end-dump type equipped with 12-in. roller-bearing wheels and axles. Grades are in favor of the loads, and two men are assigned to a car.

Stope chutes have wooden slide gates opened with bars by the trammer, and the chutes on the skip pockets have vertical slide gates operated by air cylinders.

Figure 10 is a plan of the 450 level station, showing location of grizzly, shaft, and pump station.

Ore Recovery in Stopes

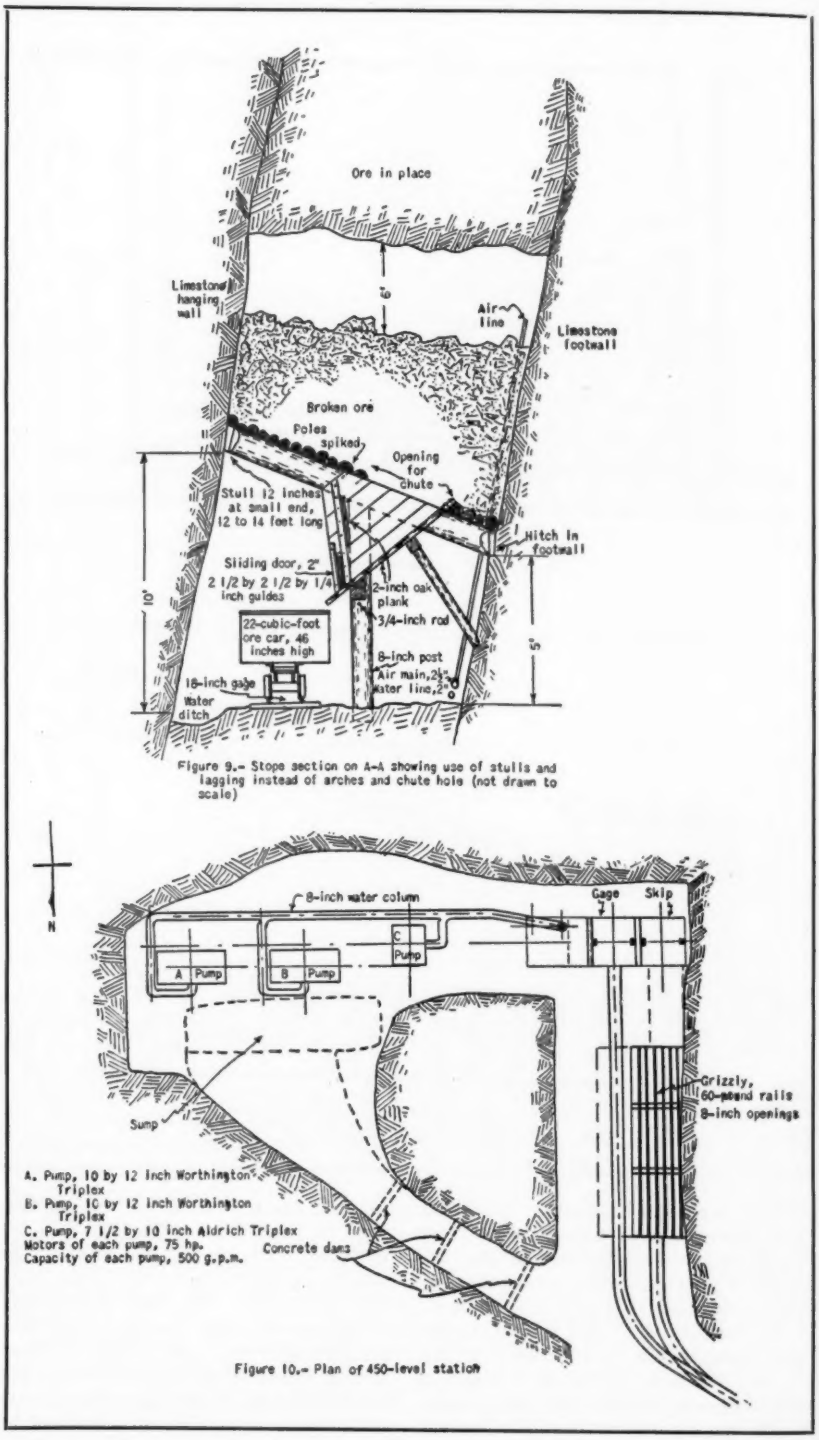
In regular shrinkage stoping all mineral-bearing material is removed from wall to wall, and whatever is left in pillars is too low grade to be considered as ore. If it is possible to do so all floor arches and stope arches are also taken out. In the square-set stopes the only material left is that which has too little mineral to be classified as ore.

A limited amount of waste is sorted underground at the grizzlies over the skip pockets, and the coarse waste is rejected there before entering the bins. As all ore entering the mill is sorted on a picking belt, waste is rejected there also.

Ventilation

The mine is ventilated by natural means, with the air shafts at the extreme ends of the mine and the main hoisting shaft in the middle. During the summer, when hot weather makes the natural air currents sluggish, a small fan is used to help the ventilation on the 170 level where the small drifts and timber impede the air currents.

Although the temperature underground is always satisfactory in summer the humidity approaches the saturation point.


Ore in place
Limestone hanging wall
Air line
Limestone footwall
Broken ore
Poles spiked
Opening for chute
Stull 12 inches at small end, 12 to 14 feet long
Hitch in footwall
Sliding door, 2" 2 1/2 by 2 1/2 by 1/4 inch guides
2-inch oak plank
3/4-inch rod
22-cubic-foot ore car, 46 inches high
8-inch post
Air main, 2½
Water line, 2
18-inch gage
Water ditch
10'
5'
Figure 9.- Stope section on A-A showing use of stulls and lagging instead of arches and chute hole (not drawn to scale)
N
8-inch water column
Gage
Skip
A Pump
B Pump
C Pump
Sump
Grizzly, 60-pound rails 8-inch openings
A. Pump, 10 by 12 inch Worthington Triplex
B. Pump, 10 by 12 inch Worthington Triplex
C. Pump, 7 1/2 by 10 inch Aldrich Triplex
Motors of each pump, 75 hp.
Capacity of each pump, 500 g.p.m.
Concrete dam
Figure 10.- Plan of 450-level station

A motor-driven fan is installed on the surface at the south air shaft and blows 6,000 cu. ft. of air per minute to the 170 level and doors and bulkheads direct the air current to the working places.

The increased velocity of the air has bettered the morale of the miners, has speeded up the work, and made considerable difference in the rate of decay of timber in the drifts and haulageways, with a noticeable decrease in the fungus growth.

Wages and Contracts

Labor conditions are good, as all labor is white, and of American stock and the problem of handling aliens who can not speak English is not present. The company wage scale is as follows for 8-hour day:

Muckers and trammers	$3.50
Stope miners	4.00
Drift miners	4.50
Timbermen	4.50
Pumpmen	4.50
Hoistmen	4.50

As much underground work as possible is done by contract, either on a tonnage or footage basis.

Raising and drifting are on footage contracts, and helpers working for contractors are paid by the company at company wages.

The usual rate for raising in ore is $3.00 per ft. for labor, and after a raise is up 50 ft. a helper is furnished by the company. It is not usual to raise more than 100 ft., and the ordinary size is 5 by 7 ft. in area. The company timbermen build the ore bin as soon as there is room enough.

For a drift in ore 7 ft. high by 8 ft. wide the usual price per ft. is $3.00 for one man, and if he needs a helper he is charged with the cost of the labor. Mucking and tramming are either done by day pay or contract at a set price per car, depending on conditions and ranging from 20 to 40 cents per car of 22 cu. ft. On some contracts the contractor is required to furnish his own powder, caps, and fuse, but this depends on the location of his working place in the mine. The mining of the soft ground in the square-set stopes on the 170 level is all done by contract at a price of $2.25 per car dumped into the ore pass. This price includes mining the ore, tramming to the ore pass, timbering the stope, and filling with waste from cross-cuts in the walls. The contractors pay for powder, caps and fuse, but timber is furnished by the company, framed to standard size ready for use. The contractor has to move his own timber from the timber yard on the surface to his working place.

In measuring up the square set stopes for payment contractors are allowed 20 cars of ore per set, and the engineer's stope books are brought up to date twice a month. All work is measured up by the engineering department twice a month, on the 1st and 15th, and the men are paid on the 5th and 20th of the month.

Fire Hazards

Very little timber is used in the mine outside the 170 level, and all scrap timber is brought to the surface for disposal. The main shaft is lined with concrete for 180 ft. from the surface, and below that the only timber used is for the guides and the dividers that support them. The main air shaft is constructed similarly. Both shafts are wet, and all the levels have more or less water dripping. All electric wiring is put in according to best practice for precaution against short circuits and is inspected weekly.

Safety and First Aid

The operation is not large enough to justify the services of a safety engineer, but his duties are performed in part by the mine engineer and regular inspections and reports are made. First aid training is given to regular classes of the men by the Bureau of Mines rescue car which visits the district regularly.

A safety committee, consisting of the heads of the departments and the superintendent and mine engineer, meets regularly and discusses and acts upon all reports and recommendations of the safety engineer. This work has been of great benefit in decreasing the number and severity of accidents.

1. Summary of Costs

Hillside Mine, January 1 to December 31, 1929; tons ore hoisted during period, 51,208; mining method, shrinkage and square set.

2. Summary of Costs in Units of Labor, Power and Supplies

Hillside Mine, average month, 1929; tons ore mined and hoisted, 5,088; mining method, 75 per cent shrinkage and 25 per cent square set.

	Development and mining
A. Labor (man-hours per ton):	
Breaking (drilling and blasting)	1.226
Timbering	.278
Shoveling, haulage and hoisting	1.022
Supervision	.041
General	.163
Total labor underground	2.730
Average tons per man-shift	2.930
Labor, percentage of total cost	70
B. Power and supplies:	
Explosives (lbs. per ton)	1.8
Timber (linear ft.)	1.5
Power in kw.h. per ton:	
(1) Air compressor	4.9
(2) Hoisting	1.2
(3) Pumping	3.3
(4) Lighting	1.0
Total	10.4
Other supplies in percentage of total supplies and power	15
Supplies and power, percentage of total cost	30

1—UNDERGROUND COSTS PER TON OF ORE HOISTED

	1 Labor	2 Supervision	3 Compressed-air, drills and steel	4 Power cost	5 Explosives	6 Timber	7 Other supplies	8 Total
Development:								
(1) In Ore	$0.121	$0.007	$0.020	$0.017	$0.062	.....	$0.004	$0.231
(2) In Rock	.095	.004	.009	.009	.020	.....	.015	.152
Mining	.700	.020	.115	.087	.219	0.082	.053	1.276
Transportation (underground)	.368	.020	.....	.....	.....	.....	.011	.399
General underground expense	.365	.....	.....	.025	.....	.....	.014	.404
Surface expense (directly applicable to underground operation)	.124	.....	.....	.....	.....	.....	.014	.138
Total	1.773	.051	.144	.138	.301	.082	.111	2.600

SELENIUM PRODUCTION CAN BE INCREASED WHEN DEMAND WARRANTS

The production of selenium, one of the little-heard-of elements could be largely increased if demand so required, according to the Bureau of Mines. Selenium is an essential constituent of several minerals. The commercial source, however, is the relatively minute amounts present as impurities in various ores, and manufactured as a by-product in the refining of copper and lead, and from the manufacture of sulphuric acid from pyrite. In the United States alone, the potential production of selenium, virtually as a by-product of major metallurgical operations, has been estimated at 400,000 to 450,000 pounds annually.

The element has possible new uses and the research that has been actively in progress for many years is likely to uncover additional fields of employment. New uses are being continually found for selenium in the medicinal and chemical industries, but the amount required has hitherto been too small to have much effect on sales. At the present, the only possible use for selenium which may create a much larger demand for the element is its use in the rubber industry, but even in this field considerable additional research may be necessary.

The principal use of selenium and its compounds at present is as a decolorizer in the glass industry and for the production of ruby glass and ruby glazes.

Selenium, although fairly widely distributed, is not very abundant in nature. It is found associated with its sister element, sulphur. The sulphides of the heavy metals likewise are often accompanied by selenium and tellurium, presumably in the form of selenides and tellurides. The selenium is not, of course, the object of metallurgical operations, but it is recovered commercially with nickel and molybdenum as by-products from the smelting operations.

The production of selenium in the United States depends entirely upon the rather limited and uncertain demand for the product. Up to within recent years the output of selenium has been very erratic. Since 1922, however, there has been an exceptional growth in the sales of selenium. In that year 123,565 pounds was sold at a value of $177,542, an average of $1.44 a pound. In 1927, the latest year for which figures are available, sales increased to 284,508 pounds valued at $491,996, or an average of $1.73 a pound.

Further details are given in Information Circular 6317, "Selenium and Tellurium," by R. M. Santmyers, copies of which may be obtained from the United States Bureau of Mines, Washington.

COAL

NEWELL G. ALFORD
Editor

Practical Operating Problems of the Coal Mining Industry

SAFETY ACHIEVEMENTS of a Pennsylvania Bituminous Coal Mine*

By **Frances Feehan**†

SAFETY first is no longer merely a motto; in some industries and in some parts of the mining industry it is an accomplished fact. In connection with the National Safety Competition of 1928 in which 284 mines and quarries participated, 42 plants were operated without a single lost-time accident. The winning company in the bituminous group had an accident severity rate of 0.053 per thousand man hours of exposure. Excellent safety records of various kinds are becoming more and more frequent, and the indication is that in rea ity safety is first in many mines and qus ries. The safety achievements in the Stewart mine of W. J. Rainey, Inc., are unusual even among mines winning awards in the competition.

THE OPERATING COMPANY AND ITS POLICY

W. J. Rainey, Inc., is a commercial coal company, of which Scott Stewart is president; J. R. Maust, vice president; D. D. Dodge, general superintendent; and Robert Wood, assistant. The main office is in the Vanderbilt Concourse Building, New York, and the operating office is at Uniontown, Pa.

At present the company is operating 11 mines in the Pittsburgh bed in Westmoreland, Fayette, Washington, and Greene Counties with 3,500 employes and an estimated production of 6,000,000 tons annually.

It is significant that this company has been operating in this district on a large scale since 1881, and although the mines are extremely gassy and a large number of major mine disasters have occurred in the district, no major disasters have taken place in the mines of the W. J. Rainey company during this period of nearly half a century.

The company has carried its own compensation insurance since the compensation law went into effect in January, 1916.

COMPANY SAFETY POLICY

The safety policy of the organization is actively supported by every official from the president, vice president, and general superintendent down to the officials and employes at each mine.

A safety department is maintained and a thoroughly progressive safety director, F. S. Lenhart, is in charge. The central safety organization is headed by the general superintendent, his assistant, and other operating officials. The safety director is secretary, and under his direction at each monthly meeting, reports on the progress made at each mine in the promotion of safety are made and discussed.

A safety organization, maintained at each mine and headed by the mine superintendent in charge, is composed of the mine foreman and all other officials and employes that may be requested to attend.

Once a month and oftener if circumstances warrant, meetings are held at which time all matters relating to the safety of the employes are thoroughly discussed and action is taken for greater advancement in safety. The company safety director attends each monthly meeting, and informs the members of the best safe practices and aids in the solution of all safety problems presented.

Safety educational meetings of all employes at each mine are held about once each month or as often as is practicable. Company mine officials and the safety director arrange for and address such meetings.

The safe direction of the employes is given further attention by daily visits of mine officials to each workman. The company has definite safety rules, which are revised whenever it is deemed advisable and are rigidly enforced in so far as practicable.

Special attention is given to the safe direction of new employes; the practice of safety, and the observance of the state mining laws are made a condition of employment for both mine officials and employes.

One phase of the safety record of W. J. Rainey, Inc., for all mines during 1928 was that approximately 500,000 tons of coal were mined per fatality. The average production per fatality for Pennsylvania bituminous mines for the same period was 255,603, and for the United States it is estimated to be 264,331; hence this company produced nearly twice as much coal per fatality as did the average mining company in the bituminous mines of Pennsylvania or of the United States.

DESCRIPTION OF THE STEWART MINE

The Stewart mine, named after Scott Stewart, president of the company, is situated at Southwest, Westmoreland County, 10 miles south of Greensburg.

The hoisting shaft is 185 ft. and the

* Reprinted from U. S. Bureau of Mines Information Circular 6258.
† Mine Safety Commissioner.

air shaft 225 ft. deep. The tipple is of steel construction with a large concrete bin having a capacity of 1,000 tons. The coal is automatically dumped from the mine cars at the hoisting shaft into the bin. The coal from this bin is conveyed by 8-ton electrically operated lorries on a special track over a distance of 700 ft. to the steel railroad tipple where the coal is dumped into railroad cars and dispatched.

The shaft was sunk in 1920 and coal shipments began in January, 1921. This mine has operated continuously since it was opened. The solid coal area available has been worked out, and for the past year or more, coal production has come from entry pillars which have been extracted to within a few hundred yards of the shaft bottom.

The 200 men employed at present work on three consecutive shifts, and the company officials expect the Stewart mine to be depleted and abandoned in 1930.

Gas Conditions

The Stewart mine has been classified as gassy by the Pennsylvania Department of Mines since it was opened in 1921. Approved electric cap lamps and permissible explosives have always been used.

System of Mining

The coal bed has a nearly uniform thickness of 9 ft., and lies practically flat except for infrequent occurrences of local sags in the strata. The coal is soft and friable except near the roof, where it is considerably harder; it is reasonably free from impurities. About 1 ft. of draw slate and several feet of intermixed roof coal and slate immediately overlie the bed.

The prevailing practice in this district of leaving 6 to 12 in. of top coal for roof support has been followed at this mine. The room-and-pillar system of mining is used. Rooms are driven narrow, and the room pillars are extracted to the entry pillars on the retreat system.

For the first five years this mine was in operation, air-punching machines were used for undercutting. Since they were removed, hand-pick mining has been employed. At present splitting methods are used on pillars and the coal is overcut by hand picks about 8 in. from the top of the bed. Blasting is done by holes placed near the bottom.

System of Haulage

Electric trolley locomotives are used on the main haulage, and horses are used for gathering from the working places.

Safety Record of the Stewart Mine

The very good safety record of the Stewart mine extending over a period of nearly nine years of operation, with its large production and large number of man hours of labor, is probably unexcelled in the history of coal mining in the United States or in any other country in so far as is indicated by available records.

Certificate of Honor Presented

This record attracted the attention of the officials of the Joseph A. Holmes Safety Association, and at its annual meeting in Washington, D. C., on March 5, 1928, a certificate of honor was awarded the Stewart mine for having operated without a fatality or an accident entailing permanent or partial disability from January 1, 1921, to February 20, 1928. From January 1, 1921, to December 31, 1927, an average force of 266 men were employed, production being 2,991,831 tons and hours of exposure 3,825,680.

Safety Statistics

The data given above extend to February 20, 1928; additional data given in *Table* 1 show that this extraordinary safety record has been continued to August 31, 1929. The record shows the noteworthy fact that from the beginning of operation of this mine in 1921 to August 31, 1929, notwithstanding the fact that practically 3,750,000 tons of coal had been produced involving more than 4,700,000 man hours of exposure, there had not been a fatality or a permanent total disability or even a permanent partial disability accident in the mine. Truly a wonderful record!

No Disabling Injury Period

Another notable achievement in the promotion of safety credited to the Stewart mine is that of operating for a period of seven months and eight days consecutively without a disabling injury to an employe.

The injury that broke this record was the laceration of a finger of a workman, who remained idle for one day following the day he received the injury. The man claimed that he had remained absent from his employment to transact some personal business and not on account of the injury. If this had not occurred, the period probably would have been extended several additional months.

At the time this record was made it was the best of its kind known for a coal mine. *Table* 2 gives details:

Gas and Fire Hazards

The efficient control of the gas and fire hazard during the period that the Stewart mine has been in operation is evidenced by the perfect safety record maintained as regards accidents from fire and gas.

Although this mine has always been classified as gassy, it is a noteworthy fact that not even a local explosion of gas has occurred, not one workman has been even slightly burned with gas, not a workman has been overcome with black damp, and not one fire has occurred.

This record is more impressive when it is known that mine fires and local explosions which often result in the loss of one or more lives are of relatively common occurrence, and numerous major mine disasters in which five or more lives are lost have taken place in the Pittsburgh bed close to, or within a radius of approximately 30 miles of the Stewart mine. *Table* 3 lists some of these disasters.

Comparative Statistics

A comparison of the safety record of the Stewart mine with the coal-mine death rates per million man hours worked, or what is commonly termed "hours of exposure," for Pennsylvania bituminous mines and the whole industry in the United States emphasizes the number of deaths that might have occurred at the Stewart mine during the years this safety record was established.

According to statistics available on this basis, the man hours of exposure given in *Table* 1 for the Stewart mine compared with the death rate per million man hours for Pennsylvania bituminous mines indicates that if the Stewart mine had had an average accident rate, 6.7 or in round numbers seven deaths would have occurred during the life of the mine.

Compared with the death rate on this basis for the entire coal mining industry, 9.5 or in round numbers 10 deaths would have occurred.

Table 4 gives the possible reduction of fatalities in Pennsylvania bituminous mines and in the United States coal mines had fatalities been eliminated as was done at the Stewart mine. This table shows that if mining had been as safely prosecuted in all of the bituminous coal mines of Pennsylvania as in the Stewart mine there would have been a saving of 3,345 lives during the eight years and eight months of the good-record period at the Stewart mine.

Nonfatal Disabling Injuries

In the absence of reliable statistics showing the number of disabling injuries occurring in the coal-mining industry, an estimate of the number of nonfatal disabling injuries that might have occurred at the Stewart mine has been made.

According to statistics contained in *Table* 44 on pages 138 and 139 of the Eighth Annual Report of the Mines Department of Great Britain for the year ending December 31, 1928, 169 disabling injuries, each involving more than three days' disability, occurred for each fatality in British coal mines. This number

TABLE I—SAFETY RECORD OF THE STEWART MINE PERIOD JANUARY 1, 1921, TO AUGUST 31, 1929

Year	Average employes	Total time worked by all employes hours	No. accidents per million man hours of exposure	No. days lost per 1000 hours of exposure	Production short tons
1921	75	186,600	144.69	1.565	125,740
1922	125	311,000	38.585	1.219	192,104
1923	245	603,680	61.291	1.395	454,494
1924	290	721,520	44.351	.441	562,268
1925	265	646,600	30.931	.266	503,378
1926	260	676,880	22.161	.337	575,235
1927	270	679,400	11.775	.224	577,346
1928	220	566,575	7.060	.136	506,160
1929 (8 months)	200	314,084	9.552	.611	252,759
Total 8 yrs. 8 months	1,950	4,706,339	33.572	0.564	3,749,484

disabling injuries, or 244 less than the average estimated for the Pennsylvania bituminous mines. On the same basis as for the United States, there would be an average of 570 disabling injuries, or the efforts made for safety at the Stewart mine prevented 412 disabling injuries to its workmen. It will be observed that there were no permanent total or permanent partial disabilities at the Stewart mine, and the average number of lost days per injury was extremely

Fatalities, Injuries and the Number of Lost Days

	1921		1922		1923		1924		1925		1926		1927		1928		1929	
	Acci-dents	Lost days	Acci-dents	Lost days	Acci-dents	Lost days	Acci-dents	Lost days	Acci-dents	Lost days	Acci-dents	Lost days	Acci-dents	Lost days	Acci-dents	Lost days	Acci-dents	Lost days
Fatalities	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Permanent total disability	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Permanent partial disability	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lost-time accidents compensable	8	208	4	333	15	743	10	224	6	113	6	174	3	113	3	75	3	192
Lost-time accidents noncompensable	19	84	8	46	22	99	22	94	14	59	9	55	5	39	1	2	..	..
Total	27	292	12	379	37	842	32	318	20	172	15	229	8	152	4	77	3	192

Total compensable injuries..... 58 — Lost days 2,175
Total noncompensable injuries..... 100 — Lost days 478
Grand total ..... 158 — Grand total 2,653

TABLE 2—Operation Data Covering Period in Which No Lost-Time Disabling Injuries Occurred at Stewart Mine, July 9, 1927—February 17, 1928.

Period	Work days	1927 Shift	Hours	Production short tons
July 9 to 31	18	5,094	40,752	36,000
August	27	7,641	61,128	54,000
September	26	7,358	58,864	52,000
October	25	7,075	56,600	50,000
November	25	7,075	56,600	50,000
December	26	7,358	58,864	52,000
		1928		
January	25	7,075	56,600	50,000
February 1 to 17	15	4,245	33,960	30,000
Total	187	52,921	423,368	374,000

Average number of employes: 283.
Average production daily: 2,000 tons.

TABLE 3—MAJOR MINE DISASTER* IN THE PITTSBURGH THICK BED

Date	Name of mine	Place	Cause	Killed
Feb. 20, 1884	West Leisenring	West Leisenring	Explosion	19
Oct. 27, 1884	Youngstown	Uniontown	do.	14
June 16, 1890	Hill Farm	Dunbar	Mine fire	31
Jan. 27, 1891	Mammouth	Mount Pleasant	Explosion	109
Sept. 23, 1898	Umpire	Brownsville	do.	8
July 24, 1899	Grindstone	Grindstone	do.	5
Dec. 23, 1899	Sumner	Sumner	do.	19
June 10, 1901	Port Royal No. 2	Port Royal	do.	19
Nov. 21, 1903	Ferguson	Connellsville	do.	17
July 6, 1905	Fuller	Searight	do.	6
Oct. 13, 1905	Clyde	Frederickstown	Mine fire	6
Nov. 15, 1905	Braznell	Bentleyville	Explosion	7
Dec. 1, 1907	Naomi	Fayette City	do.	34
Dec. 19, 1907	Darr	Jacobs Creek	do.	239
Nov. 28, 1908	Rachel and Agnes	Marianna	do.	154
July 24, 1912	Superbo and Lemont	Evans Station	Cloudb'st, flooded mine	18
June 2, 1920	Ontario	Cokeburg	Explosion	6
Feb. 2, 1922	Gates No. 2	Brownsville	do.	25
July 25, 1924	Gates No. 1	Brownsville	do.	10
April 26, 1925	Hutchison	West Newton	do.	5
May 19, 1928	Mather No. 1	Mather	do.	195
Total number of employes killed				946
Total number of disasters				21

* Major mine disasters are those in which five or more persons are killed.

TABLE 4—Possible reduction of fatalities if all mines had the record of the Stewart mine

Year	Pennsylvania bituminous mines, number killed*	United States coal mines, number killed†
1921	286	1,995
1922	436	1,984
1923	402	2,462
1924	349	2,402
1925	309	2,234
1926	420	2,518
1927	356	2,231
1928	514	2,176
1929 (8 m'n'hs)	‡274	‡1,329
Total 8 years, 8 months	3,346	19,321

* Data from Table 57, page 88, of U. S. Bureau of Mines Bulletin 293, Coal Mine Fatalities in the United States 1927, by W. W. Adams.
† Data from Table 1, page 3, same publication.
‡ Subject to revision.

would be materially increased if all disabling injuries of one or more days lost time were included.

The National Safety Council in a recent publication (Accident Facts, 1929, p. 48) estimated the number of nonfatal lost-time injuries to be 130 for each industrial fatality.

United States Bureau of Mines Report of Investigations 2938, May, 1929, entitled "The National Safety Competition of 1928," on pages 7 and 8 gives the following data, based on the records of 66 bituminous mines participating in this contest: fatalities, 41; permanent total disability, 1; permanent partial disability, 64; temporary disabling injuries incurring loss of one or more days beyond date of injury, 2,384; grand total, 2,490. These data indicate that approximately 60 nonfatal injuries occurred for each fatality, and this figure will be used, as it appears to be based upon the most conservative and representative data available.

During the period of the safety record at the Stewart mine under discussion 6.7 deaths were prevented; this also represents 402 disabling lost-time injuries as the average for Pennsylvania bituminous mines. The Stewart mine had 158 low, being slightly less than 17 days per injury.

Economics of Safety at the Stewart Mine

An estimate of the economic savings effected during the period of this safety record at the Stewart mine is based only on such data from the Pennsylvania Workman's Compensation Law as are available.

During the years covered in this record, the waiting period after injury for which no compensation was paid was 10 days, until it was reduced to seven days on January 1, 1928. The maximum weekly payment was $12 until it was increased to $15 on January 1, 1928.

The annual report of the Bureau of Workman's Compensation, 1928, by William H. Horner, director, published in the February, 1929, number of *Labor*

and Industry, issued by the Department of Labor and Industry, Harrisburg, Pa., states that during the years 1921 to 1928, inclusive, 12,593 awards were made in fatal dependency cases, incurring an expenditure of $43,945,424 in compensation, or an average of $3,492.92 compensation per case. During this period awards were made in 603,548 compensation cases, involving $102,110,619 in compensation paid, or an average of $167.53 per compensation case.

On the basis of an average compensation payment of $3,492.92 per fatal dependency case, the prevention of 6.7 fatalities would alone effect a saving of $23,403, and the prevention of 9½ fatalities would save $33,183.

Of the 158 disabling lost-time injuries that occurred at the Stewart mine, 58 were classed as compensable cases. The total compensation paid by the company was $6,361. The average cost per compensable injury was $109. The average cost of compensation per ton of coal produced during the period from January 1, 1921, to August 31, 1929, based on $6,361 compensation paid and 3,749,484 tons of coal produced, was 1.7 mills. In many instances coal mines working under essentially similar conditions have compensation costs up to 5 cents or more per ton of coal produced.

Other economic losses which accompany fatalities and injuries to employes are less apparent and more difficult to estimate than compensation costs and are said by reliable safety engineers to be four times greater than the amount paid in compensation.

Compensation costs would include such items as administration of compensation, medical care, hospitalization, first-aid training and equipment, property damage, interruption of operations, replacement and training of new workmen, reduced morale, strained industrial relations, and similar expenses. All of these factors seriously affect the cost of production, are obscure, and are frequently overlooked by mine officials or mine owners.

The principal factors affecting economic losses to the employes from fatalities and injuries are as follows: loss of wages, physical impairment, reduced earning capacity, reduced initiative, discontentment, and similar factors, which probably total several times the dollars and cents actually received in compensation by employes.

It is not uncommon to find that the cost of workman's compensation payments alone averages 5 cents per ton of coal produced over a period of years at the mines of many companies operating in the bituminous fields; in some instances this figure is exceeded.

It is also evident that mining companies and mines that maintain low frequency fatality and injury rates through efficient organized safety effort have correspondingly low compensation costs per ton, and it almost invariably follows that the mine having the best safety record has also the lowest cost of operation and production compared with all other mines in the same coal bed of the district.

Safety Methods at the Stewart Mine

In addition to rigid compliance with the state mining laws and the company safety policy, there are other factors that have contributed to the unexcelled safety record of the Stewart mine.

In conducting this investigation the writer went into the mine and visited a number of working places with Mine Foreman Smith, interviewed a number of employes, and talked with the state mine inspector of the district. All attribute this safety record to the efficient direction of the working force and the safety organization which was conducted so successfully that at all times there was a maximum of cooperation between the mine officials and the employes in the promotion of safety.

For the past year or more the mining hazard has been greatly increased by the overweight on the pillars that are being extracted. During the recent visit to the working places it was evident that this hazard was being controlled successfully by efficient timbering, and every workman seemingly was trained to safeguard himself from injury without constant direction from the foreman or his assistants.

The roof and other hazards on the haulageways were given constant attention; the haulageways were kept clean, and the haulage men as well as other day workers seemed to have the same interest in safety as the face workers.

The cleanliness and order maintained in the shops, hoisting and fan house, tipples and tracks, and everywhere on the outside was impressive, and it was evident that every worker was trying to perform his duties in the safest manner.

It has been a practice at this mine for the superintendent and the mine foreman or his assistant to visit each workman's place of employment at least two times at irregular intervals during each shift.

The practice of safety is made a condition of employment for all mine officials and employes. For infractions of the mining laws, the company safety rules, neglect of duty, or doing work unsafely, those found guilty are either reprimanded, suspended, or discharged, depending on the gravity of the offense. But seldom has an official or employe been either suspended or discharged, for Mr. Middleton, the superintendent, takes special pride in his ability to convert all employes under his direction to the practice of safety.

When new workmen are employed Mr. Middleton personally instructs them in the safety policy of the company and obtains a promise of cooperation. Special attention is also given to new employes by the assistant mine officials to be certain that they are safe and efficient workmen.

Sixty men have been trained in first aid since this mine was opened, and 25 have been trained in mine-rescue work. First-aid and mine-rescue equipment is always available.

The safety slogan of the W. J. Rainey Company is much in evidence, and reads as follows:

Our Motto:

Production With No Accidents

Every official and workman at the mine and their families are as proud of the safety record established at the Stewart mine as is the superintendent upon whom the responsibility for the safety of the employes primarily rested.

Superintendent Middleton's Part in Accident Prevention

Upon reviewing the safety record of the Stewart mine, readers may form the opinion that it has had a preponderence of good luck, but consideration of the extended period of nearly nine years during which the record has been maintained should dispel such claims. Others will immediately reach the conclusion that the officials in charge of the mine must have experienced tremendous difficulties in making such an outstanding safety record. Such a conclusion is entirely incorrect, for when the writer interviewed Mr. Middleton on this subject the question was asked:

"Do you experience much difficulty in maintaining this high standard of safety that has prevailed at the Stewart mine?"

He answered promptly:

"No, I regard it as the simplest problem connected with the successful operation of a coal mine."

Mr. Middleton's safety record as a mine official had been established long before he took charge of the Stewart mine, as will be shown by the following wording of the award of the Joseph A. Holmes Safety Association to Mr. Middleton in 1929:

"The Joseph A. Holmes Safety Association awards to F. E. Middleton, Superintendent of Stewart and Perryopolis mine, W. J. Rainey, Inc., Southwest, Pennsylvania, this certificate of honor for having acted from 1905 *to* 1919 *as coal-mine foreman and from* 1919 *to* 1929 *as superintendent. During the entire* 24 *years only one fatal accident occurred to the* 200 *or more men under Mr. Middleton's direct jurisdiction."*

Mr. Middleton's achievements and those of the Stewart mine in the promotion of safety are convincing proof that coal mining (*Continued on page* 722)

The SAFETY COURT of the Harlan Fuel Company

By **Charles S. Guthrie***

OUR company had seen the need for a safety movement for a long time, but we looked around to find a method that would train our men, and at the same time get their minds in a receptive mood for real safety work. We were desirous of obtaining the support of the men employed from the beginning, and we felt that hard-boiled safety bosses, and iron clad safety rules were not the thing for us at that time, so in April, 1929, we called a meeting of our men for the purpose of organizing a safety court. The men fell in with the plan readily, and through the loyal support of our key men, the movement was started and kept going.

Our court is composed of the following officers, all elected by the men: Director, judge, prosecuting attorney, secretary, three reassurers, four white and one colored magistrate, three committees, namely, rules committee, fine committee, and dangerous practices committee.

Each new man is given a book of our rules, and instructed to study them before returning to work, and to carry them out while at work, then we try to see that he does carry them out.

The court works as follows:

Anyone seeing another violate a safety rule applies to a magistrate for a warrant. This warrant gives the date, the violation occurred, name of defendant, name of man taking out the warrant, all necessary witnesses to secure the case, and the signature of the magistrate.

The warrant is then turned over to the sheriff, whose duty it is to bring into court the defendent and all witnesses.

The defendent may defend himself, or if he is not up on his law, he may employ a lawyer to defend him, and we have some shrewd ducks too, when it comes to lawyers.

The prosecuting attorney takes the case in behalf of the safety court, the judge ruling and passing fines in most all cases, but in a few cases a man is allowed to have a jury trial. The amount of the fine depends on the nature of the violation, and how many times a man has been up before.

In connection with the court we run the safety reels furnished by the Bureau of Mines; we also break the monotony of the court by giving free minstrel shows and various entertainments.

The funds of the court are being used to purchase emblems, which are given to a man if he works 60 days without a single demerit, and attends safety court twice each month. If he works six months without a demerit then his emblem is exchanged for one showing he has worked six months without a demerit and so on. We hope to make these emblems hard enough to get so that they will serve for a recommendation when a man is looking for work in this field, and should one of our men apply for work at one of your mines wearing one of our emblems, you can rest assured that he is a safe man.

In addition to the safety court, we employ two safety bosses who assist the foremen in looking after the safety of the men and mine. Our engineer, who was elected safety director by the men, also spends his spare time working on safety.

We investigate our accidents, and if we find that it was due to the carelessness or negligence of anyone, that person is properly disciplined.

In order to let the men know at all times how we are getting along with our accidents, and to keep the safety move on their minds, we have a flag pole 50 ft. high with rings painted 10 ft. apart, when there are no accidents the flag flies from the top of the pole, one accident it is lowered to first ring, two accidents, second ring; death, half mast and so on. Each Monday morning the flag is hoisted back to the top of the pole.

We also use all kinds of signs and notices to help sell the movement to the men.

We use permissible explosives and have decided on 100 percent rock dusting which we are doing as fast as possible. We use a scaling crew to take down all loose rocks on our haulways.

Our records show that the "Fly By Night" coal digger, who does not stay with us long enough to learn to work safely, and furthermore, who doesn't intend to learn, is the greatest menace to our safety record that we have, and we intend to give the gentlemen proper attention in the future.

Tabulated below is the cost per ton each month before and after inaugurating our safety work.

We also pay our foremen a bonus of $5 a month when they run the full month without an accident.

The result of our safety move in dollars is shown in the table below.

Going back one year before our court was organized, in order to get a comparison to the year we have been running it, and there was a larger tonnage in the year previous, of 37,915 tons, due to the slack work since January this year.

The average cost per ton of our compensation, before organizing, was $.0385. The cost per ton for the past year has been $.0101, or there has been a saving per ton of $.0283, which multiplied by our tonnage, shows a saving for the year of $15,193.66.

Another saving which we can not figure is the non-interruption of tonnage, more tonnage per man, and better satisfied workmen. We ran more coal with safety than without.

In conclusion, I want to say that we are sold on safety. We have seen the results and we know that, aside from the humanitarian standpoint, safety pays dividends in dollars and cents. My earnest advice to one and all is to get into practicing safety. You will never regret it.

	Before tonnage	After tonnage	Before cost per ton	After cost per ton	Before compensation paid	After compensation paid
May	47,070.20	49,121.25	.005089	.004929	$239.58	$242.14
June	48,424.65	45,646.30	.000132	.011114	6.43	507.35
July	48,308.70	45,778.55	.005708	.018328	275.78	839.04
August	52,177.75	52,005.90	.012008	.014188	626.58	737.89
September	51,019.60	51,315.80	.074784	.013444	3,815.46	689.90
October	53,368.85	54,190.65	.023170	.005840	1,236.57	316.49
November	47,232.60	45,079.40	.036370	.008362	1,717.87	376.99
December	43,843.25	49,023.50	.014132	.012369	131.77	619.62
January	54,030.30	55,236.55	.126543	.013885	6,837.18	767.00
February	51,949.45	34,442.00	.008859	.00224	460.26	77.12
March	44,561.40	25,929.00	.098730	.01089	4,399.57	282.52
April	33,160.70	29,464.00	.072484	.00051	2,403.65	15.00
	575,147.45	537,232.00	.038513	.01018	$22,150.70	$5,471.06

.02833 saving per ton. $15,193.66 total saving

* General Superintendent, Harlan Fuel Company, Yancey, Ky.

The Fallacy of Arguments Against Mechanized Loading

Objections to mechanized loading are met by the economic necessity for coal mining to keep pace with modern industrial progress.

By G. B. Southward

THERE are three arguments used against the adoption of mechanized loading. One is that loading machinery is economical only in a limited number of mines where there are unusually favorable conditions. The second is that there is already an overproduction of coal and an excess of man-power so that machines are not needed. The third argument is simply that mechanization is not wanted. It will be the purpose of this article to consider each of these objections and to show their fallacy.

The first objection—that mechanized loading is restricted to a limited set of favorable conditions has been refuted by the actual facts so many times that it is hardly worth repetition. Statistics show that approximately 40,000,000 tons of coal were loaded with mechanized loading in the year 1929. Detailed reports show that the seam height in these mechanized operations varies from less than 2 ft. to more than 20 ft., the dip varies from level to steeply pitching, the partings are from 0 to more than 25 percent of the seam, the operations are both in union and non-union fields, with wage scales varying from the lowest to the highest paid in the United States, and the coal is sold in a range from run of mine to highly prepared domestic sizes. This record should certainly be a convincing proof that mechanized loading has been found applicable to every condition that has been imposed on hand production.

It is not the idea of this article to say that every coal mine in the United States could be operated profitably by the installation of loading equipment. Certain mines have difficulties introduced by their natural conditions—low quality coal, impurities in the seam, bad roof, faults and other irregularities—which make them unprofitable at the present time for operation with mechanized loading or with hand loading for that matter. For such mines mechanization can reduce the losses which are now occurring but it can not entirely overcome adverse natural conditions in competition with seams where the difficulties are not present. In other words, mechanization will not make all seams equal. There are places, therefore, where mechanization would not be profitable and where the argument of unfavorable conditions does apply. But this application is limited to individual cases only and not to all mines of any one state or district. Coal men should not overlook the possibility that there are a sufficient number of seams in each district suitable for operation with some type of mechanized loading to supply the market demand.

The argument that mechanized loading is not needed by the coal industry is one which has the least foundation. There has never been a time in the history of coal when a high efficiency in mining was needed so badly as it is now. For a number of years the coal consumer has been steadily improving his combustion methods with a corresponding decrease in the amount of coal used. The decreased fuel consumption is one of the main contributory causes for the present over-production and the resulting low price of coal. In an effort to adjust themselves to the changing conditions the hand loading mines have lowered their operating costs to some extent by various measures of rigid economy but the costs have not been reduced in proportion to the decreased market price of coal. In this respect coal mining has not kept pace with the efficiency that the consumers have shown and among many operators there is an acute feeling of resentment as though this were part of a plot. The actual situation is that the coal industry has tried to hold its place in modern industrial progress by continuing mining practices developed years ago when labor was cheap and plentiful. This has proved impossible as the losses with hand loading have shown.

It is probably true that costs with hand mining have now been brought to a point which is approaching an irreducible minimum. This is true of hand loading only, because in hand mining there is lost time and lost motion which is an inherent part of the system. If we consider each phase of mining separately it is possible to see how these inherent losses can be eliminated or reduced by complete mechanization.

The cutting methods in a hand loading system necessarily involve considerable travel in taking the machine from place to place. Because of the fact that a room is seldom loaded out in one day a machine can not cut the places in sequence along an entry but has to skip the rooms which are not cleaned up. In contrast with this, mechanized loading makes a complete cleanup in a small number of adjoining working places. Consequently the distance and the time of travel for the cutting machine is greatly reduced. The rapid rate of mining with mechanized loading and the desirability of increasing the tonnage per working place usually leads to driving the rooms wider than was done with hand loading. This in turn, potentially increases the capacity of the cutting machine by reducing the number of moves and the number of setups necessary for a given tonnage.

Hand loading requires single car placement at the working face. This means that the gathering unit has to make a considerable travel for every car that is loaded. With mechanized loading the operation is confined to one working place at a time which is served by the gathering unit, handling cars in small trips to or within a very short distance of the working face. The result has been to give a much higher efficiency in the gathering operation. Not only is the cost reduced but the decreased travel and the quick time of loading has materially increased the number of round trips made by the mine car during the shift.

In a hand mine the large number of working places needed for the production has required a very extensive haulage system. The cost of installing and maintaining track is such that it is necessary to economize on the material. As a consequence the steel rails used are too light for the service and frequent wrecks occur on both the gathering and the main line haulage. With mechanized loading inadequate track has been replaced by heavy rail with rock ballasting and haulage delays have been almost eliminated.

The extended number of working places with hand loading has been responsible for inadequate power line installations underground. In many instances it is impossible to locate a central substation close enough to all the working places where sufficient power can be furnished for the machines. As

a natural result the line drop is excessive, the operation of the machines is retarded and frequent breakdowns and interruptions occur. All of these are costly yet few hand loading mines can afford the investment necessary for adequate power transmission through all of their underground workings. With mechanized loading the concentration of the mining area is such that the investment cost for a proper power line is not prohibitive. In the better class installations now going in this is resulting in much higher efficiencies in the use of power and it is reported at some mines that the installation of mechanized loading has not increased the power cost in proportion to the increased use of electricity underground.

There is no doubt but what there is at the present time sufficient man-power in the mines to produce all the coal needed by continuing hand methods. From this viewpoint there is no immediate need for increasing the production per man and it is argued that the adoption of machine methods will increase unemployment among coal miners. The change from hand to machine mine necessarily involves an adjustment of labor and if this change were made abruptly it would cause much hardship and suffering. If, however, the period of adjustment does not proceed too rapidly, the labor released from the mines will naturally be absorbed by other industries. In the end this will be a very good thing for all concerned.

Coal miners by reason of the skill required are entitled to a wage and a scale of living comparable to that enjoyed by men similarly employed in other lines of work. The present market price of coal is such that the best wages which can be paid for the low rate of production with hand methods can not yield them more than a mere existence. A fewer number of men producing a greater tonnage with the higher wages afforded by machine methods would create a much better labor situation in coal mining than exists today.

There is another angle to the labor situation that is worth taking into account. The intermittent and part time employment is causing a considerable drift of labor away from the mines. Unfortunately for the coal industry the men who are leaving it are almost without exception the better type. There is little hope of inducing these men to return to the mines as long as the present situation continues and the younger men whose fathers and grandfathers were coal miners are not willing in this machine age to take jobs of loading coal with the hand shovel. A mechanical operation seems to be the only solution for attracting and holding a desirable class of men in the mines and some solution will soon be badly needed.

The argument that mechanization is not wanted is one which applies to individuals only and can be set aside as having no effect on the ultimate adoption of mechanized loading in coal mines. There have been few cases in history where an innovation or a new method was ever wanted when it was first developed. Steamboatmen did not want the railroad, railroadmen did not want the automobile truck, yet the opposition, individual and organized, which was directed against each of these new enterprises could do no more than temporarily retard their progress. The opposition and the arguments against mechanized loading which have been used in the last few years have not prevented its adoption and its successful operation. Individual opinions and desires can not prevent a movement which is fundamentally correct, and the adaptation of machine methods to all phases of coal mining is being forced by economic pressure regardless of whether we want it or not.

SAFETY ACHIEVEMENTS

(*from page* 719)

can be made a comparatively safe occupation and that there are no hazards connected with it that can not be successfully controlled by the proper application of human intelligence. It is to be hoped that his safety record and that of the Stewart mine will inspire all mine officials throughout the United States to put forth greater effort to bring about a substantial and permanent reduction in the excessively high fatality and injury rates prevailing in the mineral industries, and especially in coal mining.

FUEL BRIQUETS IN PACIFIC NORTHWEST

The annual production of fuel briquets in the Pacific Coast states amounts to about 100,000 tons valued at approximately $1,000,000, as compared with a production of 1,000,000 to 1,250,000 tons valued at nearly $10,000,000 for the United States as a whole, according to the Bureau of Mines. Four of the 25 plants in the United States manufacturing fuel briquets are located in the Pacific Northwest. Three of these plants are in or near Seattle, Wash., and one is located at Portland, Oreg. There is also one plant in California. The plants in the Seattle district use the buckwheat sizes of washed coal as raw material, according to the Northwest Experiment Station of the Bureau of Mines, Seattle, Wash. The other two plants use oil carbon, a by-product obtained in the manufacture of gas from oil, which requires no binder in briquetting.

Two of the plants in the Seattle district employ petroleum asphalt as a binder for briquetting either mixtures of coking and free-burning coals or coking coal entirely. The third plant is using a process which seems especially adapted to the manufacture of briquets from free-burning bituminous or subbituminous coal.

WASHABILITY STUDIES OF MARY LEE COAL SEAM

A study of the washability of coal from the Mary Lee coal seam at Lewisburg, Ala., has been conducted by the Bureau of Mines at its Southern Experiment Station, Tuscaloosa, Ala.

The Lewisburg No. 2 mine of the Sloss-Sheffield Steel & Iron Company is located in Jefferson County, Alabama, about seven miles due north of Birmingham. At this point the coal from the Mary Lee seam when coked in by-product ovens yields an excellent quality of metallurgical coke suitable for use in the iron blast furnace; it is also an excellent steam coal. In mining, all three benches are worked. Coarse impurities are largely gobbed by the miners underground.

The problem of washing the Mary Lee seam at the Lewisburg mine is one of ash reduction, according to B. M. Bird, B. W. Gandrud, and E. B. Nelson, in Report of Investigations 3012, just published by the Bureau of Mines.

The most important features of the problem are (1) the cleaning of a large proportion of fine sizes; (2) a difficult separation according to specific gravity in the preparation of coal containing less than 10 percent ash; (3) the rejection of "rash," a local term for flaky impurities; and (4) the disposition of a shale that slimes into the circulating water.

Two general plans of washing this coal for coke-making suggest themselves, One is to sell the sizes coarser than three-fourths inch or 1 in. for steam raising or other purposes not requiring a coal of low ash content. The other is to crush them to a comparatively fine size and wash them with the natural slack sizes. This step has been shown to render the mine-run coal appreciably easier to wash.

Regardless of whether the coarse sizes are crushed and added to the slack sizes or not, provision should be made for making a middling product when the washed coal is to be under 10 per cent ash. The amount of middlings can be minimized by keeping the washers up to high efficiency. It can further be reduced by disposing of the egg and nut sizes for steam raising or other purposes.

As jigs are so widely used in Alabama to wash the Mary Lee seam, some methods have been outlined briefly in this report for handling the large percentage of fine sizes and the rash in this washer.

Nevada Cons. Wins Suit Against Cons. Copper Mines Over Method of Mining

The Nevada Consolidated Copper Company was granted judgment against the Consolidated Copper Mines Company in a decision rendered August 1 by Judge Frank H. Norcross, of the United States District Court at Carson City, Nevada, and the defendant corporation was enjoined from mining ore underground in an area that would endanger the Liberty pit workings of the Nevada Consolidated Company until that company completes its pit operations.

The decision brings to a close a complicated and strongly contested case. The suit was filed May 20, 1929, and went to trial October 21 after filing of a stipulation to govern both companies in the interim. Suit was to interpret a contract entered into between the plaintiff and defendant corporations in 1926 relating to the mining of ore in the territory of each other. The two properties adjoin and cover a huge deposit of disseminated copper ore at Kimberly in White Pine County.

By the terms of the contract, Consolidated Copper Mines was to mine ore of Nevada Consolidated west of a certain line, through its Emma Nevada shaft. The Nevada Consolidated Company desired to continue open pit mining and alleged that operations underground of Copper Mines endangered its pit workings and ground adjacent to its Wedge shaft, through which it proposed to conduct underground mining when pit mining should be discontinued.

New Owners Plan Development of California Rand

Extensive development of the Kelly, Coyote, Santa Fe and Silver Queen mines of the old California Rand Silver at Randsbury, Calif., will be conducted by the Worthley Consolidated Mines, Inc., owner of the property. The concentrator started early in August on ore from the Kelly mine.

The California Rand Silver, Inc., was the largest producer of silver in the United States in 1921. After operating the mines less than ten years and paying over $4,000,000 in dividends the company sold the entire property for $50,000 and liquidated. The purchaser, H. W. Klipstein, of Bakersfield, Calif., transferred title to the Consolidated Metals Corporation of San Francisco, which operated several months at a profit. This company sold the mine two months ago to the Wortley Consolidated.

Jack Waite Reorganization Plans Are Voted at Meeting

Under reorganization plans approved at a special meeting in Wallace, Idaho, August 18, stockholders in the Jack Waite Consolidated Mining Company will receive one share of stock in the reorganized company for five shares of their old stock. The company will incorporate under Arizona laws as the Jack Waite Mining Company.

Capitalization is set at $3,500,000, divided into 3,500,000 shares of a par value of $1 each. This compares with the former capitalization of $5,000,000 divided into 5,000,000 shares, practically all of which was issued.

The new plan will result in approximately 1,000,000 shares being issued with 2,000,000 shares to be sold as treasury stock to finance new development and construction work. The remaining 500,000 shares will be placed in the treasury to be used in purchasing additional property.

An elaborate development program, which will cost approximately $380,000, was outlined at the meeting. A shaft will be sunk from the Idaho tunnel to a depth of 500 feet to explore the mine at additional depth.

In addition to this a 480-foot raise will be extended from the Idaho tunnel, now more than 5,000 feet long, to connect it with the bore driven from the Montana side.

It is also planned to reconstruct the old mill and after this is done, increase its capacity to 500 tons daily. W. L. Ziegler, Hecla Mining Company metallurgical engineer, inspected the plant a few months ago and advised the owners that much reconstruction was necessary before increasing capacity.

The company also plans on buying the railroad, which comes within four miles of the property, and also constructing an additional four miles of tracks to bring the line up to the mine.

Adjoining ground, which the company plans to purchase, includes the Duthie-Dunlap and Archie Smith properties.

Silver Investigation Under Way

Official action looking toward the betterment of the silver situation was put under way August 6 when Senator Pittman, of Nevada, as chairman of the subcommittee on Foreign Relations, opened hearings at Washington, D. C., to ascertain the causes of America's rapidly declining trade with China, and to determine to what extent the slump in the price of silver is to blame.

While the hearings are to deal essentially with our import and export trade with China, the investigation will subsequently go more particularly into the silver situation, hearings being scheduled at Reno, Salt Lake City, Denver, Spokane, and other western cities.

A statement issued by Senator Pittman after the opening hearing indicates that it will be the purpose of the subcommittee, after the hearings have been concluded, to recommend the drafting of a new treaty with China under which that oriental country may have outside assistance in getting back on its feet, and at the same time have its finances stabilized through the helpful cooperation of the United States and other nations that have enjoyed vast commercial relations with China in the past.

The dates for hearings by the subcommittee have not been definitely fixed, other than one set for San Francisco August 27. Beginning that day the committee will hear importers and exporters engaged in Chinese trade, to ascertain the extent of decline in commerce with China, and the causes. Five or six days will be devoted to the San Francisco hearings, after which several days will be devoted to hearing other importers and exporters at Los Angeles, with similar hearings to be held immediately thereafter at Seattle.

After getting the views of Americans engaged in trade with China, the committee will conduct hearings in Salt Lake City, Reno, Spokane and Denver, at which representatives of the silver mining industry may be heard. The Salt Lake hearings will be not later than September 15.

Dr. Julius Klein, Assistant Secretary of Commerce, in a statement submitted to the Pittman committee, attributed depressed trade with China to three factors, the military activities in China; low prices in world markets, and the low price of silver. He thought it well that

the United States began to look after its interests in China, for he said other nations are already alert and competition for Chinese trade is ever increasing among the great powers. England already, he reported, has named a commission of leading business men to visit China and study the problem as it affects British trade.

This body is to report back to the British government. In so far as silver is a contributing factor, Dr. Klein stated that the Shanghai tael, worth 64 cents in 1928, is today worth but 38 cents. The Chinese naturally can not buy as much abroad with their present tael as they could two years ago, he pointed out.

John W. Finch Dean of Idaho School of Mines

Dr. John W. Finch, Denver mining engineer, has been named dean of the University of Idaho School of Mines to succeed Dr. A. W. Fahrenwald.

Dr. Fahrenwald was given temporary appointment after Dr. Francis A. Thomson resigned a year ago to accept the presidency of the Montana School of Mines.

W. D. Vincent, commissioner of education, said an agreement had been reached by which Dr. Finch and Dr. Fahrenwald would pursue lines of investigation already begun—Finch in the field of electro-metallurgy and Fahrenwald in chemistry and geology.

"Dr. Fahrenwald accepted the deanship," Commissioner Vincent said, "with the understanding he would be permitted soon to return to experiments which he had been carrying on for many years and through which he has won an outstanding place in the mining world."

Dr. Finch has been a lecturer in the Colorado School of Mines for several years.

Determination of Cadmium

A technical paper on "A Method for the Determination of Cadmium in Mill and Smelter Products," has just been issued by the University of Utah. The authors are W. E. Keck, G. L. Oldright, and F. K. Shelton. It is listed as No. 12 of the technical papers on mining and metallurgical investigations which are carried on cooperatively by the U. S. Bureau of Mines and the Department of Mining and Metallurgical Research of the Utah Engineering Experiment Station of the University of Utah.

The information contained in this paper is the result of the work which was done in the Department on the development of a rapid and accurate method for the analysis of cadmium, in connection with the studies which have been carried on in the Department on the recovery of cadmium from mill and smelter products.

The use of cadmium has increased greatly during the last few years. This fact has stimulated production of the metal and research on the methods for its recovery. However, no rapid and accurate method for analysis seems to have been worked out. The older methods of analysis either could not be applied to zinc concentrates and like materials because of interfering substances, or they were exceedingly long and required special apparatus, which was not conducive to the analyses of a large number of samples simultaneously. It was for this reason that attention was turned to developing a rapid method for the determination of cadmium.

The method for the analysis of cadmium as described in this paper is technically accurate, rapid and adapted to determinations in quantity. Special apparatus and reagents are not required. A complete and detailed description of the analytical procedure is given along with a discussion of the research that led to the development of this analytical method.

Silver Production—July

Production of silver in the United States in July was 3,638,000 fine ounces, compared with 3,969,000 in June and 4,528,000 ounces in July, 1929.

Canadian production, according to incomplete returns, was 2,100,000 ounces, compared with 1,485,000 ounces, in June and 1,910,000 ounces in July, 1929. Mexican production in June, the latest month for which figures are available, was 10,270,000 ounces, compared with 9,080,000 ounces in May and 8,386,000 ounces in June, 1929, according to the American Bureau of Metal Statistics.

World silver output in June, the latest month for which figures are available, is placed at 18,607,000 ounces, against 18,237,000 ounces in May and 17,802,000 ounces in June, 1929.

Stocks of silver in the United States on August 1 were 459,000 ounces, against 737,000 on July 1 and 682,000 ounces on August 1, 1929. Stocks of silver in Canada on August 1 were 312,000 ounces, against 441,000 ounces on July 1 and 339,000 ounces on August 1, 1929.

Manganese Imports Large This Year

Imports of manganese ore into the United States during the first six months of the current year, with the exception of the comparable period of 1926, were larger than for any first half year on record, according to the Minerals Division, Department of Commerce.

Total imports for the 1930 period amounted to 370,903 long tons, representing an actual manganese content of 178,389 long tons in comparison with 342,959 long tons, with an actual manganese content of 165,602 long tons for the first six months of 1929, when consumptive demands of the steel industry, then operating near capacity, were considerably higher than at the present time. The current year's increase in U. S. imports in the face of a stagnant world manganese market is believed by the trade to be in fulfillment of contracts made in 1929.

Russia, Brazil, Gold Coast and India furnished approximately 98 percent of the total imports during the period, with Russia holding the largest share of 47 percent. Shipments from that source showed a gain of more than 20,000 tons over receipts for the same period of 1929.

Brazil's contribution to the United States imports of manganese amounted to 107,700 tons, approximately 30 percent of the total. This compares with 130,850 tons imported from that country during the first six months of 1929.

For the time being the Gold Coast has definitely replaced India as the third most important source of United States receipts of manganese, and indications are that imports from this source will continue to mount as long as a favorable market exists. During the first six months of the current year this section supplied 51,807 tons, or 14 percent of total imports, compared with 5,606 tons during the corresponding period of 1929.

British India continues to be an important factor in the United States import trade, although shipments from that source have continually declined since the re-entrance of the American market by Russian ores.

Electric Resistibility Studies Being Made In Michigan Mining Districts

The departments of physics, geology and electrical engineering of the Michigan College of Mining and Technology at Houghton are cooperating this summer in continuing the study of the electrical resistibility of various rock formations in the copper and iron districts of Michigan. The work is part of a program to concentrate research at the college along lines which will be of greatest assistance to the mining industries of the state. The object of the studies is to obtain intimate geological information, which will be of value in directing exploration in the future.

Electrical resistibility of various formations are being studied in the field. Present indications are that by this method it will be possible in many locations to determine the depth of the water table without drilling. It appears that different kinds of rocks possess different properties of electrical resistivi-

ties, so it is possible by this method to determine geological formations which are covered to a considerable extent with glacial deposits.

The magnetic permeability of different rocks also is being studied. This study is undertaken to get scientific facts underlying the striking variation in magnetic attractions being used in mapping the geology of the districts. By means of the magnetic or dip needle it is possible to follow the flows of beds along their strike, thus solving some of the structural problems of the district, faulted areas are encountered and mapped.

Considerable new information regarding the geological structure and currents already has been obtained. The projected work in the field, however, involves long periods of activity in both the copper and iron districts.

Metal Rate Hearings at St. Louis and New York

Further hearings will be held by the Interstate Commerce Commission at St. Louis on November 18 and at New York on December 10 in its investigation of the freight rate structure on nonferrous metals. These will be the final hearings unless the railroads or shippers request that additional direct or rebuttal evidence be heard. The St. Louis hearing will cover the lead and zinc industry in the southwest and the New York hearing will also cover the zinc situation and general rate and transit questions.

Ore From El Paso Mines Co. Dump To Be Treated in Golden Cycle Mill

A combination drag and aerial tramway, with a loading capacity of 200 tons in eight hours, has been ordered and will be installed on the orehouse mine dump of the new El Paso Mines Company on Beacon Hill, Cripple Creek, Colo., where, it is said, more than 100,000 tons of low-grade ore are available for shipment to the Golden Cycle mill at Colorado Springs. One hundred and fifty carloads of the low-grade, shipped to the mill during the last two years, shows an average value of slightly better than $4 a ton. The ore was shipped by shoveling into cars and tramming to the railroad, carrying with it considerable coarse rock.

The tram, to be installed near the main shaft, connected with the present head frame and electric hoist, operates on an aerial cable, arranged so that the carrier bucket may be dropped for its load at any point desired. When loaded, it is raised by tightening the carrier cable, thus accomplishing both the work of a drag and aerial tram. It will carry about 3,000 pounds to a load. A loading "hopper" will be built adjacent to the railroad with sufficient height to permit a direct load into the cars, the ore sorted over a two-inch screen and the coarse reject turned back over the dump by gravity.

Big Jim Gold Mines Increases Holdings at Oatman

The Big Jim Gold Mines Company has acquired title to the Aztec and North Aztec mining claims which adjoin the Big Jim mine on the north, in the Oatman District of Arizona.

The claims, among the early locations in the district, composed a part of the large holdings of the George Hartman interests, and more recently were known as the Oatman Gold Mining Company. They side-line the Big Jim and end-line the Blue Bird claim which with the Templor was purchased recently by the Tom Reed Gold Mines Company from the old Oatman Combination Mining Company.

There is a big cross-cut north from the 500-foot station of the Big Jim shaft which terminates at the side-line of the Aztec claim. From this point holes will be drilled to locate the vein, to be followed by development through the Big Jim shaft.

Owing to a difference of 175 feet in elevation of the Big Jim shaft and that of the Black Eagle it will only be necessary to sink the Big Jim 225 feet to gain the same depth. The Big Jim shaft is 700 feet deep at present. Retimbering will be completed to the 500-ft. level, from which lateral work will immediately follow.

Carson Hill Mine Sold

With filing of articles of incorporation of the Carson Hill, Ltd., a California corporation, comes word that final steps have been taken in acquisition of the vast holdings of the old Carson Hill Gold Mines, Inc., at Melones, near Angeles Camp, Calif.

Lawrence Monta Verde, a director of the new company, states 1,000 acres are in the tract, and that the California State Mining Bureau shows the properties taken over have a production record of $61,000,000. Work has begun, he says, and states within a few months 200 men will be employed.

C. & A. Smelter To Erect New Steel Stack

Awarding of a contract for construction of a new steel stack at its Douglas, Ariz., smelter was announced August 18 by the Calumet and Arizona Mining company. The stack will be 279 feet high, and while no information was available from official sources its cost is said to approximate $70,000.

The new stack will be of structural steel on the outside and will be lined with brick. The base or bell will be 36 feet in diameter, and from that point to the top will be 20 feet 6 inches in diameter. It is understood that the contract calls for delivery of the material and completion of the work within a period of 80 days, but definite time for starting was not announced.

The new stack is required to meet the need arising from the rebuilding of the smelter, which has been in progress during the past year.

Will Investigate Colorado Radium

G. F. Loughlin, of the U. S. Geological Survey, is preparing to make a survey of radium-bearing ores of Southwestern Colorado.

Loughlin is head of the section devoted to metalliferous deposits. He plans to find out, as accurately as possible, the value and extent of carnotite bodies of Paradox Valley and Southeastern Utah.

The study is being undertaken at the request of the House Committee on Mines and Mining, in connection with legislation pending before Congress for radium production by the Bureau of Mines.

Soupcoff Joins Staff of New York Brokerage House

S. M. Soupcoff, Salt Lake mining representative for the American Smelting & Refining Co., has resigned his position to become associated with the Moore, Leonard & Lynch Company, New York investment banking and brokerage house.

Mr. Soupcoff graduated from the Colorado School of Mines. He started his professional work with the Anaconda Copper Mining Company at Butte. Work with John Farish, distinguished mining engineer, followed which took him to Alaska, Mexico and South America. In 1913 he took a position with the American Smelting & Refining Company and came to Salt Lake in 1916.

500-ton Shale Oil Plant in Estonia

Preliminary work has been started on the construction of a shale oil distilling plant with a daily capacity of 500 tons of shale, according to reports to the Department of Commerce from Tallinn, Estonia. The company is said to be negotiating with a foreign financial group on the financing of the new plant. It has already obtained a contract from the Estonian Government for the supply of shale oil to the Estonian railways, which plan a gradual change from the use of coal and shale to the use of shale oil as fuel.

Seven Lost Time Accidents in Phelps Dodge Corporation During July

The Morenci Branch, with no time-lost accidents in any department, led all other branches of the Phelps Dodge Corporation in the July safety campaign of the various P. D. units.

The Copper Queen Branch with only one time-lost accident was in second place for the month while the Moctezuma Branch with the same number was third. The Old Dominion Company of Globe ranked fourth with two time-lost accidents in July and the Stag Canon Branch was fifth with three. Only seven time-lost accidents were chalked up against the five branches during the month and only four against the copper mining properties, considered a remarkable record in accident prevention and safety work.

A rather unusual feature in connection with the July contest was that all seven accidents occurred in the underground mining department.

A total of 62 time-lost accidents have been chalked up against the five branches since January 1, the Old Dominion with only five, leading for the year to date. The Morenci Branch with 10 time-lost accidents is in second place for the year to date; the Copper Queen with 21, third; the Moctezuma with 15, fourth, and the Stag Canon with 11, fifth.

Geologic Report on Famous Wood River Region, Idaho

Some unusually complicated geologic features and interesting mines are described in a report recently issued by the Department of the Interior as Geological Survey Bulletin 814, entitled "Geology and ore deposits of the Wood River region, Idaho," by J. B. Umpleby, L. G. Westgate, C. P. Ross, and D. F. Hewett. The area studied contains over 900 square miles and includes the most productive mine of south-central Idaho.

Stratified rocks that attain a maximum thickness of about 30,000 feet underlie a large part of the region. These were intruded by several large bodies of granitic rocks, and after a long lapse of time lava flows were spread over much of the surface and other bodies of granitic rock were intruded. Probably the most uncommon geologic feature displayed in the area consists of the flat thrust faults which extend diagonally across it.

There are many mines in the region, and the value of their total output to date is estimated at more than $25,000,000, of which one mine, the Minnie Moore, has furnished about $7,500,000. The report contains a special study of the geology of this mine. The period of greatest activity in the Wood River region extended from 1880 to 1892, when most of the mines were discovered. During recent years the production has been obtained by the intermittent operation of a few mines and has varied widely. Silver-bearing lead ore has been the outstanding product, but a few mines have produced zinc, gold, and copper ores. Many of the mines have encountered complicated faults, which have hampered continuous operation. Report available from Superintendent of Documents, Washington, D. C., 90 cents.

Treasury Department Hears Complaint of Manganese Producers

After hearing manganese producers and representatives of organized labor in behalf of suspension of imports of manganese ore from Russia, Assistant Secretary of the Treasury Lowman and officials of the Customs Bureau postponed further consideration of the case until September 9 when representatives of the American Iron and Steel Institute and the Amtorg Trading Corporation, American agent of the Russian producers, will be heard.

J. Carson Adkerson headed a delegation of officials of the American Manganese Producers Association and owners of prospective manganese development in Virginia, South Dakota and Nevada, which included H. A. Pumpelly, J. M. Leute, O. Stange, E. S. Clark, B. S. Barrow and C. W. Massey. The American Federation of Labor was represented by W. C. Roberts, and Thomas L. Doherty appeared for steel producers, while the Amtorg company was represented by A. C. Bickford. H. N. Lawrie for Senator T. L. Oddie of Nevada, submitted data concerning the adverse effect on the development of the domestic manganese industry by the dumping of Russian manganese, which the Senator has asked be stopped.

In charging that "the American manganese industry is being wrecked by the ruthless dumping program of Soviet Russia, whereby convict or forced labor is being used in the production of manganese and other materials, sold in America without regard to sales price or cost of production," Mr. Adkerson asked the Treasury "to withhold the appraiser's report and liquidation of entries of such manganese until additional dumping duty, under the act of 1921 is ascertained and assessed."

According to Mr. Adkerson, "Soviet agents in the United States have offered to undersell any American producer of manganese ore, regardless of what price the American or other producer may quote."

Mr. Doherty, representing the steel producers, stated that manganese ore is a world product and commands a world price. He stated that it will be shown that the prices for Russian ore are substantially the same as those of other world manganese producers. He pointed out that manganese is now higher than the pre-war level as compared with copper and tin which are lower in price. There is no danger of an immediate flood of manganese ore imports, he said, in view of the pending agitation for their restriction, because of the slump in the steel industry.

When Assistant Secretary Lowman stated that the papers submitted by the producers were conclusions, and that the department must have facts on which to base its decision, Mr. Adkerson said he preferred to give the additional facts in confidence to the officials. Mr. Lowman said there was a difference between an industry which is injured by competition and one which may be damaged by cut price practices. It was made plain that it must be shown that the product is sold in the United States at less than in the home market or in the export market to other countries.

Mr. Pumpelly in reciting the failure of his company to secure a reasonable price on ore produced at Butte in cooperation with the Anaconda Copper Mining Company alleged that Russian importers were willing to sell ore in this country below the domestic or other foreign ore prices in order to get the business. The price in this country on American ore should range between 65 and 68 cents per unit, he said, but that the company had not secured more than 61 cents a unit and had lost $60,000 on the operations. The Russian ore is selling at 50 cents a unit. Mr. Pumpelly said the Russian ore averaged a manganese content of 50 percent while the American averaged 57 percent. In cooperation with the Anaconda Company and the Bureau of Mines, the company had developed processes which would produce ore of a manganese content of from 60 to 62 percent.

The manganese producers testified that because of the situation created by the Russian imports, which had forced the price down to as low as 47½ cents a unit as compared to a previous five-year average of 68 cents per unit, 6 major operations and 25 undeveloped companies were idle.

Mr. Clark said the Chapin Exploration Company was prepared to build a 450-ton plant near Las Vegas, Nev., but could not under present depressed conditions. This plant would be able to produce 250,000 tons a year.

Russian imports of manganese have advanced from 4 percent to 46 percent of the total to the United States since 1922.

Mr. Adkerson stated that his mines in Virginia could produce 130,000 tons of ore annually.

Mr. Leute stated that the Carnegie Steel Company formerly graded the price on manganese from 45 cents per unit on 40 percent ore to 65 cents on 50 percent

ore, but that the same price is now quoted on all grades. He estimated that the cost of Russian production is now greater than it was 20 years ago.

Mr. Roberts read a resolution from the mine, mill and smelter union of Butte complaining of unemployment due to the Russian competition against American ore and made a general plea against allowing the imports to injuriously affect American workmen.

Mr. Stange declared that he had ore deposits in 40,000 acres in southwestern Virginia capable of producing 7,000,000 tons of ore of a 50 percent manganese content. He has invested $750,000 in the property and could install a plant in six months capable of producing 300 tons a day at a price of 50 cents a unit at the mine.

Mr. Massey said his properties could not operate at less than a price of 50 cents per unit at the furnace. In closing the producers' case Mr. Adkerson declared that there is enough capacity under construction and development in the United States to take care of all of the manganese requirements of the country.

Reports were quoted to the effect that Russia is losing heavily on its manganese production, by selling the ore for 6 cents per unit less than the production cost.

Efforts are likely to be made to unite the manganese, anthracite and other producers in an effort to exclude Russian products because of their injury to the American industries.

Iron Ore Shipments

Iron ore shipments from upper lake ports in July totaled 8,586,649 tons, compared with 10,670,882 in July, 1929. Shipments for the season to August 1 totaled 24,324,222, compared with 32,910,820 in 1929. Ore receipts at Lake Erie ports in July totaled 6,345,995, compared with 7,509,408 in July last year. Receipts for the season to August 1 were 16,097,792, compared with 22,436,384.

First-aid and Mine-rescue Contest at Louisville September 16, 17 and 18

When the International First-aid and Mine-rescue Contest opens in the Jefferson County Armory at Louisville, Ky., on Tuesday, September 16, members of the various teams from all parts of the United States and those from foreign countries, as well as mine operators and visitors, will be given a surprise in the form of a complete exhibit of all permissible supplies and machinery used by the present-day mining industry.

With all indications now pointing to the largest entry list of teams in the history of the contest, the local executive committee, under the chairmanship of John F. Daniel, chief of the Kentucky Department of Mines, of Lexington, is bending every effort to have every detail of the event so arranged that there will not be the slightest hitch and that all of the visitors are given every care for their comfort and enjoyment.

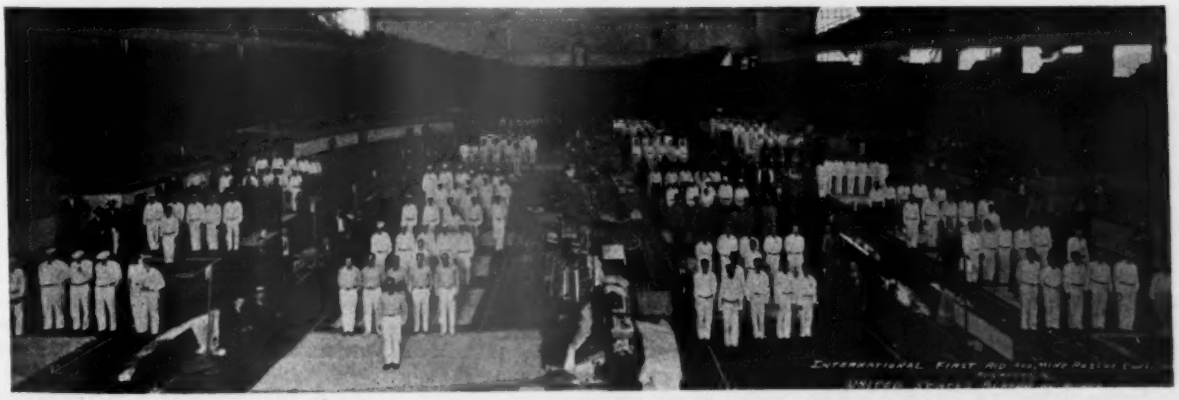
The Jefferson County Armory is located within the hotel and theater district of Louisville and is within a short walking distance of the heart of the business section. It is one of the largest buildings in America without a pillar or post in its main hall, which is 196 by 270 ft., surrounded by a wide balcony. Beneath the balcony on all sides will be placed the exhibits of supplies and machinery in booths each 10 by 10 ft., and the displays are expected to be a revelation to the visitors, as well as a liberal education in the newest developments in mine equipment and safety appliances.

The gallery used in the mine-rescue contests will be erected in the center of the hall, the roof of which is 90 ft. to the peak. Suitable arrangements for dressing rooms, etc., have been made so that there will be no inconvenience or loss of time in each team preparing for its appearance. Officials of the United States Bureau of Mines who inspected the hall before Louisville was chosen as the location for the contest pronounced it the best structure for the purpose they ever had seen and are enthusiastic over the probabilities for the most successful contest ever held.

Entries thus far made show that there will be well over 100 teams entered and they are coming from all parts of the country. Kentucky, which is in the heart of the largest mining territory in the country, of course probably will provide the largest number of teams, but practically all surrounding and nearby states will be strongly represented and it is the purpose of the industry in the Bluegrass State to see that the visitors not only have a most successful contest, but that they also have a good time. Plans for the entertainment of the guests are in the hands of a special committee and they include a dinner for all the participants. Kentucky and Louisville are rich in historic lure and scenic charm and a number of side trips are being arranged for those who can extend their stay.

Among the places to be visited are Mammoth Cave, the Old Kentucky Home, where Stephen Collins Foster was inspired to write the famous song of that name; the Abraham Lincoln Memorial, including the original log cabin in which the martyred Civil War President was born; the tomb and monument of Zachary Taylor, the twelfth President of the United States; Churchill Downs, where the world-famed Kentucky Derby has been run annually for 56 years, as well as many other places of charm and attraction. Incidentally, the Louisville baseball team of the American Association, who now are leading in the race for the pennant, will be playing at home with the Columbus, Ohio, and Indianapolis, Ind., teams during the period of the contest, offering the visitors the opportunity of seeing high class baseball.

The contest will last from Tuesday, September 16, through Thursday, September 18, and every minute of the time will be occupied with some feature of interest for all who attend.



First aid teams at the International meet, at Kansas City last year, just before the contest

Consolidation Team Wins Maryland First Aid Contest

With a score of 99.55 percent, Team No. 1 of Consolidation Mine No. 12 won the Third Annual First Aid Contest conducted by the Maryland State Bureau of Mines held at Frostburg, August 9. Consolidation Coal Company teams won third and fourth prizes also, these awards being made to Team No. 1 of Mine No. 1 and Team No. 2 of Mine No. 1, respectively. The Union Mining Company, Finzel Team, ranked second, with a percentage of 99.15.

There were 24 teams on the field, representing ten Maryland coal companies.

Cash prizes were awarded the oldest working miner in years of service, the retired miner having most years of service, the oldest wife of a coal miner, the man having the largest family on the field, and the largest woman present. Dr. J. J. Rutledge, Chief of the Maryland Bureau of Mines, surprised every one by presenting the team making the lowest score with a cash prize of $10.

The judges in the contest were experienced men in first aid work and were all from outside the state.

One of the outstanding events of the day was the presentation of a J. A. Holmes Society certificate and medal to Randolph Ashby, an employe of the Chapman Coal Mining Company, of Barton, Md., who, though suffering with a broken collar bone and other injuries received by a fall of rock, removed an injured fellow-workman from under the same fall and brought him safely to the surface.

National Safety Council Mining Section to Meet at Pittsburgh

The Mining Section of the National Safety Council will meet at Pittsburgh, Pa., September 29 to October 3. An interesting program has been prepared and every phase of safety work is covered. On Tuesday, September 30, T. G. Fear, General Manager, Consolidation Coal Company, Fairmont, W. Va., will speak on "Safety Responsibility of Management," and A. R. Pollock, General Manager of Mines, Ford Collieries Co., Curtisville, Pa., will speak on "Safety Responsibility of the Foreman, Shift or Face Bosses."

On the afternoon of September 30, P. G. Beckett, Vice President and General Manager, Phelps Dodge Corporation, Douglas, Arizona, will speak on "Some Fundamental Requirements in Successful Accident Prevention Work," and W. D. Brennan, President, Utah Fuel Company, Salt Lake City, will talk on "Methods of Educating the Workman." On October 1, D. L. Boyle, Superintendent of Mines, Associated Gas & Electric System, Johnstown, Pa., will talk on "Safety Organization for a Small Company"; Carl T. Hayden, General Manager, O'Gara Coal Company, Chicago, will talk on "Safety Organization for a Large Company."

Problems of the State Mine Inspectors will be discussed on Thursday morning, October 2, by the following mine officials: W. H. Glasgow, Secretary of Mines, Harrisburg, Pa.; R. M. Lambie, Chief, Department of Mines, Charleston, W. Va.; J. F. Daniel, Chief, Department of Mines, Frankfort, Ky.; W. B. Hillhouse, Chief Mine Inspector, Birmingham, Ala.; and J. G. Millhouse, Chief Mine Inspector, Springfield, Ill.

Utah and Idaho Coal Dealers Face Trade Commission Complaint

Charges of unfair methods of competition in interstate commerce in violation of the Federal Trade Commission Act was brought by the Federal Trade Commission against the Idaho Coal Dealers Association, the Utah Coal Producers Association and the Retail Fuel Dealers Association of Utah.

The commission issued a complaint charging the defendants with entering into a "conspiracy to restrain, restrict and suppress competition in the sale and distribution of coal in interstate commerce" by refusing to recognize other than its own members as retail coal dealers and by refusing to transport or sell coal to other than those members.

The commission also charged the three associations with entering into an agreement whereby their recognized retailers would have "the exclusive business" of selling coal to "all domestic consumers, all states, and counties and municipalities, and schools where truck or wagon service is required and to the employes of industrial concerns."

The effect of these agreements, the commission declared, "was to limit and allot the sale of coal in interstate commerce" to the members of the three associations in restraint of trade.

Miller Coal Company in Receivership

The affairs of the Miller Coal Company, which operates a leased coal mine at Portage, Cambria County, Pa., were placed in the hands of a receiver by Judge Oliver B. Dickinson in the Federal District Court at Philadelphia, August 14, after involuntary bankruptcy proceedings were instituted by three creditors, with claims totaling approximately $280,000. John C. Forsyth was named receiver by the court.

The court at the same time issued an injunction restraining the Johnstown Coal & Coke Company, from whom the Miller Company leased the mine, from going through with a constable's sale to collect unpaid rentals.

Tipple Burned in Kentucky Coal Field —Incendarism Charged

The 60-ft. tipple at No. 3 Mine of the Province Coal Company, Province, Ky., was destroyed by fire August 14, with a loss estimated at $50,000. A deputy sheriff who investigated the blaze said it was undoubtedly of incendiary origin. This is the highest property damage that has resulted since disorders began in Webster County July 1, when mines reopened after a three months shutdown. No. 3 mine was one of three in the county that did not open. It employed 200 men when closed April 1.

Officials said that the burning was an act of retaliation against two company stockholders who went to Murphysboro, Ill., earlier in the week and identified Paul Montgomery's airplane as the one from which bombs were dropped in Webster County, August 11.

$20,000 Bid for New River Export Company Properties

Bids totaling little more than $20,000 for properties of the New River Export Smokeless Coal Company were received at a bankruptcy sale August 2 at Fayetteville, W. Va., by Ebersole Gaines, trustee in bankruptcy. Appraisers had estimated the value of company's holdings at approximately $235,000. H. W. Todd, acting as trustee for Nuttal estate, submitted a bid of $14,000 for the Blume, Lookout and Prosperity mines of the company, at Lookout. Mountain View Realty Company of Lookout, bid $2,003 for the Michigan mine, its houses and equipment.

Carnegie Coke Plant To Install 12,000-ton Coal Washer

The Carnegie Steel Co., one of the operating subsidiaries of the United States Steel Corp., has contracted with the Koppers Rheolaveur Co. for the design and installation of a large coal washing plant at the Clairton, Pa., By-Product Coke Works, after several years of study and investigations as to the benefit of washed coal for the making of coke for metallurgical purposes.

The plant will have a washing capacity of 12,000 tons per day of 20 hours. The sizes to be washed range from 3 in. to 0. The purpose of the washing plant is to remove extraneous non-coking material from the coal, and also to reduce the sulphur, thereby making the coke more satisfactory for use in the steel plants.

When completed, the plant will cost approximately $2,000,000 and will be one of the largest and most complete plants of its kind which has ever been constructed.

Coal will be brought to the Clairton

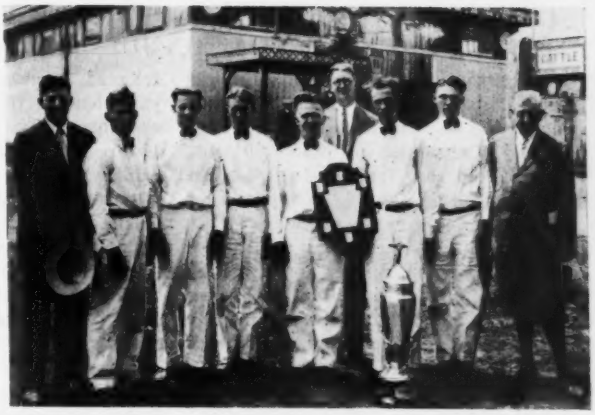
plant from the mines by barges as is the practice now and will be unloaded and handled by the existing equipment. In the line of long belt conveyors which now takes the coal from the barges to the bins over the coke ovens, there will be inserted a gate by which the coal can be diverted to the washing plant.

Immediately above and a part of the washing plant building, there will be three 1,000-ton steel storage bins in which various kinds of coal can be stored. The coal is fed into these storage bins by two shuttle conveyors. From this storage, various kinds of coal can be fed onto a mixing belt in any desired proportions. This mixing belt will deliver the coal to the plant proper where it will be washed and cleaned.

Coal below ⅜-in. in size will be mechanically dried by Carpenter centrifugal driers, while the coal above ⅜-in. in size will be dried on long dewatering shaking screens. This insures the delivery of the coal with the minimum amount of moisture to the coke ovens. After washing and drying, the coal will be fed onto a belt which will take it to the oven bins from which it is removed for charging to the ovens.

The plant is being designed to make its washing operations as flexible as possible in order to obtain the maximum ash and sulphur reduction in the various kinds and types of coal which it will be necessary to wash.

The details of this plant are just being worked out, and it will take approximately one year to build and place the plant in commercial operation.



First-aid team of the Mansfield Mine of the Pittsburgh Coal Company which took first place in the contest at Ebensburg, Pa. Left to right—C. C. Hennessy, safety engineer; Fred Loydl, Burdell Plants, August Kraft, Fred Byers, C. A. McDowell, safety and personnel manager for the company; Bruce Dodds, captain; Joe Beaumont, and Charles M. Schwab

The Pittsburgh Coal Company climaxed its fourth annual first-aid contest by winning first place in the Western Pennsylvania bituminous mines first-aid contest held at Ebensburg, Pa., in connection with the Cambria County Industrial Exposition on July 5.

This company, operating 19 mines in the Pittsburgh district, takes considerable interest in accident prevention work, one phase of which is first-aid training and first-aid competition. Three divisional contests are held each year, and the first two men teams, the first boy team, and the first girl team winning in each division meet represents their respective division in a final company championship contest which is held at Library, Pa. At that time cups, appropriate prizes, National Safety Council medals, American Red Cross medals, and American Red Cross certificates are presented to the winners.

The company championship team from Mansfield mine and the second-place winner from Montour No. 9 mine represented the company in the Ebensburg meet, Mansfield winning first place with 99.5 percent.

In the past two years the personnel of the safety and personal department, in cooperation with the United States Bureau of Mines, has trained approximately 8,000 employes in first aid, which is approximately 80 percent first-aid trained employes. In the latter part of 1929 the employes of eight mines, totaling 4,5000, were trained 100 percent and received U. S. Bureau of Mines certificates. One mine, Montour No. 10, has the distinction of having more men trained in first aid than any other mine in the United States.

Plans Completed for Stoker Exhibit at National Coal Assn. Meeting

The National Coal Association has completed plans for the stoker exhibit that will be held in conjunction with the thirteenth annual meeting at Detroit in October, and the stoker industry has been invited to display its products for the first time before a national meeting of bituminous coal producers. The exhibit room adjoins the main meeting room and offers an excellent opportunity for stoker manufacturers to place before those attending the meeting, their products. The exhibits will be confined to the household and small industrial stoker, and further confined to those that are designed to burn bituminous coal exclusively.

Hanna Buys Sagamore Coal Co.

The holdings of the Sagamore Coal Company in Indian Creek Valley in the Connellsville, Pa., region were taken over by the M. A. Hanna Company the later part of July, terminating an operating agreement under which the Hanna Company has been working the Sagamore mine since July 1. The holdings include 1,400 acres of coal land and 70 houses, 53 at Sagamore and 17 at Romney. The daily output is 600 tons of coal, and 150 men are employed.

J. E. Jones Wins West Virginia Republican Nomination for Senate

Col. James Elwood Jones, one of West Virginia's leading coal operators, became the standard bearer for the Republican Party in the November election as its candidate for the United States Senate by virtue of an impressive victory at the polls in the West Virginia state primary, early in August. Mr. Jones, who is vice president of the Pocahontas Fuel Company, and participating in his first political battle for a state-wide office, rolled up a lead of more than 60,000 votes over his opponents, who included former Congressman Rosenbloom, Judge Harry Shaw, and former Governor Albert B. White.

Colonel Jones will be opposed in the elections by former Senator M. M. Neely, who was unopposed for the democratic nomination.

Although the issue of geographical location of candidates figured largely in the campaign, returns showed that Jones, a resident of one of the extreme southern counties, carried 41 of the 55 counties of the state.

Because of ill health, Senator Guy D. Goff, of West Virginia, was not a candidate for reelection. His term expires March 4, next.

New Coke Plant Starts in West Virginia

A coke plant consisting of 48 ovens was started at Belle, W. Va., early in August by the DuPont Ammonia Company. Initial production was about 600 tons of coke daily, which will be used in the DuPont plant at Belle.

The coke ovens are entirely different from the old style beehive ovens. In addition to making coke, they also conserve all the by-products of bituminous coal. Some of these by-products are used in the DuPont Ammonia company's plant, and others are saved for sale in commercial channels.

COMMERCIAL STOCKS OF ANTHRACITE AND BITUMINOUS COAL ON JULY 1

Bituminous Coal — Consumers' stocks of bituminous coal continued to decline during the second quarter of 1930 and on July 1 amounted to 32,200,000 tons, according to the Bureau of Mines. In comparison with the 33,100,000 tons on hand at the beginning of the previous quarter, this is a decrease of 900,000 tons and it is the smallest tonnage held by consumers since the fall of 1922 when stocks had not yet recovered from the effect of the prolonged suspension of mining in that year.

The usual seasonal decline in the rate of coal consumption, which normally occurs at this time of year following the close of the heating season, was accentuated during the period under review by the depression of general business. All major classes of consumers in practically all regions of the country were consuming less coal than in the corresponding months of last year. The average rate of home consumption for the second quarter of the year was 7,614,000 tons per week. Exports amounted to 322,000 tons, and total consumption plus exports was 7,936,000 tons a week. In comparison with the same period of 1929, the rate of home consumption plus exports shows a decrease of 1,057,000 tons per week, or 11.8 per cent.

Coal on the Lake Docks—In addition to the stocks of consumers, substantial reserves were held on the upper Lake Docks. According to reports from the dock operators there was a total of 7,883,032 tons of bituminous coal on hand at the head of the Lakes on July 1. A year ago the total stocks on the Lake Docks amounted to 6,629,262 tons.

Retail Anthracite—Stocks of anthracite in retail yards on July 1 show the usual seasonal increase over the amount in storage on April 1, but are slightly less in terms of days supply than on the corresponding date of last year.

Bituminous Stocks by Classes of Consumers

At the rate of consumption prevailing in May and June, the stocks on July 1 were sufficient to last 31 days, if evenly divided. Stocks are rarely evenly distributed, however, and there were wide variations in the reserves of individual consumers. The largest reserves on July 1 were held by the coal gas plants, with 61 days' supply. Details for other classes of consumers are given below. In spite of the fact that the actual quantity of coal held by most classes of consumers on July 1 was less than on the corresponding date of last year, it will be noted that with the exception of the railroads, all classes of consumers show an increase in terms of days' supply due to the lower rate of consumption prevailing during the period under review.

DAYS SUPPLY OF BITUMINOUS COAL IN HANDS OF VARIOUS CLASSES OF CONSUMERS IN THE UNITED STATES, JANUARY 1, 1919, TO JULY 1, 1930

	Jan. 1 1919	July 1 1926	July 1 1927	July 1 1928	July 1 1929	Apr. 1 1930	May 1* 1930	July 1* 1930
By-product coke plants	32	23	40	23	21	22	21	25
Steel plants	42	26	59	38	26	25	31	31
Other industrials	65	35	64	37	27	26	28	29
Coal-gas plants	81	72	87	63	55	58	56	61
Electric utilities	49	52	76	62	50	44	62	60
Coal dealers (Bituminous)	39	43	48	43	42	16	41	51
Railroad	32	27	54	37	20	19	†	20
Total bituminous	42	34	54	38	28	23	33	31

* Calculated at average rate of consumption in May-June, 1930. † Not available.

By-Product Coke and Steel Works—Stocks at by-product plants have increased somewhat during the last three months, while the steel works report a slight decline. Complete returns from the by-product plants show a total of 4,874,546 tons of coking coal in storage on July 1, of which 3,494,826 tons was high volatile and 1,379,720 tons was low volatile. At the steel works and rolling mills 657,235 tons of steam coal and 546,799 tons of gas coal was on hand July 1, a total of 1,204,034 tons.

Railroad Fuel—The American Railway Association reports that on July 1, the stocks of railroad coal amounted to 5,647,000 tons. This is 750,000 tons less than on July 1, 1929, and is the smallest quantity the railroads have had in storage since the close of the great suspension in 1922.

Anthracite and Coke

Coal in Retail Yards—Retail dealers' stocks of both anthracite and bituminous coal have increased during the past quarter. Since April 1, the date of the last survey, anthracite stocks have increased nearly 63 per cent and at the rate the householders were calling for anthracite in May and June, the stocks on July 1 were sufficient to last 57 days. In terms of days' supply, this is a larger reserve than was on hand on the corresponding dates of either 1928 or 1927, but is slightly less than on July 1, 1929, when the rate of delivery was lower.

It was not feasible to canvass all retailers, but information was obtained from a representative group of 951 dealers scattered throughout the country who are believed to be typical. Of these dealers there were 465 handling anthracite and 768 handling bituminous coal who have reported at every one of the stock surveys since 1919.

Stocks of bituminous coal in retail yards have increased in amount by 30 per cent since the last survey, but are 3 per cent less than on July 1, 1929, and are also less than on corresponding dates of other recent years. In terms of days' supply, however, the present stocks appear to be adequate for this season of the year, being sufficient for 51 days' requirements at the rate of delivery prevailing in May and June.

Anthracite on the Upper Lake Docks—Stocks of anthracite on the Upper Lake Docks on July 1 show the usual seasonal increase, but are somewhat less than on corresponding dates in immediately preceding years. On May 1 there was 231,302 tons on the docks of Lake Superior and 167,269 tons on the docks of Lake Michigan, a total of 398,571 tons. By July 1, the total stocks had increased to 552,896 tons, of which 391,252 tons was on Lake Superior and 161,644 tons on Lake Michigan.

Summary of Domestic Fuels Used in Massachusetts

The Massachusetts Special Commission on the Necessaries of Life, the latter part of July, made public the results of its survey to determine the relative importance of the various fuels used for heating the homes of Massachusetts during the last coal year. The figures for anthracite, briquets, coke, and gas heating installations are based on definite reports, but in the case of bituminous coal and oil estimates have been made in part to avoid duplication of figures.

In the last coal year, April 1, 1929, to March 31, 1930, there was a slight falling off in deliveries of anthracite of the domestic sizes, compared to the preceding year, while the use of buckwheat sizes of anthracite and other fuels increased. Total consumption of domestic fuel for the last two years was substantially the same.

Comparative figures follow:

	1928-1929 Net tons	1929-1930 Net tons
Anthracite:		
Domestic sizes	4,913,000	4,694,000
Buckwheat sizes	138,000	160,000
Bituminous	495,000	500,000
Coke	637,000	650,000
Briquets	193,000	190,000
Oil .....gals.	80,000,000	100,000,000
Gas installations	2,925	4,344

The report further states:

"Included in the anthracite figures listed above for last season were some 390,000 tons of foreign anthracite imported from Great Britain and Russia. It will be noted, however, that despite

these imports and the development of new fuels, the great bulk of our domestic fuel supply was Pennsylvania anthracite.

"Sales of coke by retail coal dealers have been showing a gradual increase in the last few years, their sales amounting to about 30 percent of total deliveries reported last year.

"In regard to briquets or pressed fuel, there are now two briquetting plants operating on a commercial scale at tidewater ports in Massachusetts. During the past season some 81,000 tons of briquets, or 43 percent of total deliveries, were imported from Germany.

"Reports received from the oil companies showed a substantial jump in deliveries of light fuel oil and furnace oil. In this connection, 40 coal dealers reported that they now sell oil in addition to various kinds of solid fuels. Light fuel oil, which is from 3 to 4 cents a gallon less than furnace oil, appears to be in growing demand for central heating plants, and the use of furnace oil in burners that fit into kitchen stoves is a factor of increasing importance.

"Gas heating is, of course, still restricted to those able and willing to pay for this convenience; the increase, however, of nearly 50 percent in the number of central heating plants last year indicates that this fuel is emerging from what might be called the experimental stage."

Mining Research Started Under Carnegie Institute Fellowships

Ten college graduates who have been awarded research fellowships sponsored by the Carnegie Institute of Technology and the United States Bureau of Mines began work August 11 on a program of study in metallurgy and mining at the Pittsburgh Experiment Station of the Bureau of Mines.

Each of the fellows has been assigned a problem for ten months' study. While most of the problems to be undertaken are new, several of the studies will be continuations of research begun in past years. Subjects for investigation have been selected by the Mining and Metallurgical Advisory Boards, which consist of leaders in the coal and steel industry.

Four graduate students will devote their time to a study of metallurgy. They are: G. Tedford Jones, Leechburg, Pa., a graduate of Penn State, whose study will be "Viscosity of Open Hearth Slags"; Emil A. Krochenberger, Terre Haute, Ind., a graduate of Rose Polytechnical Institute, who will study the electrolytic method of determining inclusions in steel; Rush A. Lincoln, Youngstown, Ohio, a graduate of the Virginia Polytechnic Institute, who will investigate iron oxide in open hearth steel; and Miles K. Smith, Pleasantville, Pa., a graduate of Grove City College, who will study the physical properties of slags.

Six fellows will conduct research in mining problems. They are: H. W. Daeschner, of Pittsburgh, a graduate of the University of Colorado, whose problem will be "The Effect of Fusian and Related Inerts in Coal"; Bruce B. Beattie, of Transfer, Pa., a graduate of Thiel College, whose problem will be "The Arresting of Flames"; Julius Billeter, Salt Lake City, Utah, a graduate of the University of Utah, who will study the mechanism of the burning of individual particles of pulverized coal; Orville G. Hanson, Walhalla, N. Dak., a graduate of the University of North Dakota, who will continue a survey of the agglutinating power of coal; Harold J. Muendel, Woodcliffe, N. J., a graduate of Lehigh University, who will investigate the composition of low temperature tar; and Alfred L. Pope, Enid, Okla., a graduate of the New Mexico School of Mines and holder of the Master's degree from the University of Alabama, who will study the chemistry of the decay of wood.

Production of Bituminous Coal By Months, January to July

Month	1929	1930	Percent of Decrease
January	52,140,000	49,778,000	4.5
February	47,900,000	39,615,000	17.3
March	39,870,000	35,740,000	10.4
April	37,380,000	35,860,000	4.1
May	40,706,000	35,954,000	11.7
June	38,580,000	33,714,000	12.6
July	41,175,000	34,634,000	15.9
	297,751,000	265,268,000	10.9

Anthracite Research at Three Universities

An intensive and exhaustive study of Pennsylvania anthracite coal will be begun at once in three important universities, according to announcement made by Noah H. Swayne, executive director of the Anthracite Institute.

By arrangement with Lehigh University, Bethlehem, Pa., Professor Homer G. Turner has been appointed Director of Anthracite Research and will devote much of his time during the next few years to that work. Since 1918 he has been assistant professor of geology at Lehigh University.

Professor Turner has had a wide range of professional experience aside from his teaching activities. He was a field assistant on the Vermont State Geological Survey for two summers and has pursued consulting work in almost all fields of geology and mineral technology. His most important consulting work has been in coal geology, petrography, geology of building stones and cements, metallic minerals, water supply, and meteorology.

Professor Turner has made many valuable contributions to science through his writings. His most noteworthy contributions have been on the subject of Pennsylvania anthacite which he has been studying for the past ten years.

The first task of Professor Turner will be listing and sampling the different veins of anthracite in the three great basins: the Wyoming, in and about Scranton and Wilkes-Barre, the Lehigh, in and about Hazleton, and the Schuylkill, in the vicinity of Pottsville.

As a part of the program and as supplementary to the work at Lehigh, Research Fellowships in Anthracite will be presently established at Pennsylvania State College and at Yale University, New Haven, Conn.

Mr. Swayne expressed his confidence that this program for research together with the work of the Anthracite Institute Laboratory established recently at Primos, Pa., will ultimately disclose new uses for anthracite coal and benefit greatly the industry and the anthracite region of Pennsylvania.

Coal Mine Fatalities in July

Reports received by the United States Bureau of Mines from state mine inspectors covering accidents at coal mines during July, 1930, showed a higher death rate per million tons of coal produced than in June of the present year or in July of last year. The actual number of men killed was 143, which was 19 more than in the previous month and 12 less than in July a year ago. Coal production amounted to 40,373,000 tons, representing an increase of 1,476,000 tons as compared with June, 1930, and a decline of 5,795,000 tons as compared with July, 1929.

Bituminous coal mines had a higher death in July rate than in either the corresponding month last year or in June of the present year, the rate being 3.05 per million tons, as compared with 2.91 for last July and 2.91 for June, 1930. The number of men killed, 106, was 8 more than in June but 14 less than in July of last year. July production of bituminous coal was 34,715,000 tons, 1,001,000 tons more than in the month before but 6,460,000 tons less than in July, 1929.

Anthracite mines, all of which are in Pennsylvania, experienced a fatality rate of 6.54, as compared with 5.02 for June and 7.01 for last July. Deaths at this group of mines numbered 37, as compared with 26 in the previous month and 35 in July last year. The quantity of coal produced was 5,658,000 tons, 475,000 tons more than in June of the present year and 665,000 tons more than in July a year ago.

Reports made to the Bureau of Mines

covering the first seven months of the present year, show that 1,132 lives were lost in accidents at coal mines. While this was 36 less than the number killed during the corresponding period last year, the death rate per million tons did not decline, being 3.71 this year as compared with 3.44 last year, owing to the fact that the output of coal fell off from 339,613,000 tons for the seven-month period a year ago to 304,799,000 tons for the same period of the present year. Expressed in percentages, the output of coal declined 10 percent while the number of deaths declined only 3 percent.

There have been no major disasters—that is, there have been no disasters in which five or more lives were lost—in either bituminous or anthracite mines since April, but seven such disasters occurred from January to April and resulted in a loss of 88 lives. July a year ago was free from such disasters but four disasters during the previous months of last year caused the loss of 75 lives. Based exclusively on these major disasters the death rates per million tons of coal produced were 0.289 and 0.221, respectively, for the seven-month periods of 1929 and 1930.

A comparison of the accident records for the period of January to July, 1930, with the same months of 1929, shows a reduction in the death rates from haulage accidents while the other principal causes of accidents show increased rates, the largest increases being those for gas or dust explosions, and falls of roof and coal.

Cochran Resigns From American Wholesale Coal Association

Ira C. Cochran has resigned as commissioner and secretary of the American Wholesale Coal Association effective August 15. On that date Mr. Cochran became assistant administrator of the Philadelphia Retail Conference, the Philadelphia organization of retail coal dealers. Mr. Cochran has been with the American Wholesale Coal Association since 1921; first in the capacity of traffic manager, and for the past several years as commissioner. Previous to his connection with that organization he was affiliated with the Coal Traffic Department of the Pennsylvania Railroad, and Weston Dodson & Co., Inc., at Bethlehem, Pa. The executive offices of the American Wholesale Coal Association will be moved to the Union Trust Building, Pittsburgh, Pa.

Tariff Commission Chairman Named

Henry P. Fletcher, of Pennsylvania, who served more than 25 years in diplomatic posts abroad, has been selected by the President to be the new chairman of the Tariff Commission when it is reorganized on September 16. He will succeed Chairman E. B. Brossard, of Utah. By the middle of next month the President will either reappoint five of the present six commissioners or name five other new members in accordance with the plans laid down in the new tariff law for a general reorganization of the commission.

Hoover Appoints New Revenue Chief

President Hoover announced the appointment of David Burnet, Deputy Commissioner of Internal Revenue, as Commissioner to succeed Robert H. Lucas. Mr. Lucas recently was appointed executive director of the Republican National Committee.

Mr. Burnett is a native of West Virginia and has been in the Internal Revenue service for ten years.

Temple Company Appeals Trade Commission Order

The Temple Anthracite Coal Company has filed with the Third Circuit Court at Philadelphia a petition to review and set aside the order of the Federal Trade Commission that it divest itself of control of a competing company. The Federal Trade Commission charged that in this case there was the acquisition of stock in a competing company to lessen competition, in violation of the Clayton Act.

RELATIVE RATE OF GROWTH OF COAL, OIL, AND WATER POWER

Bituminous coal remained the principal source of energy supply of the United States in 1929, according to a special study by F. G. Tryon, of the Bureau of Mines. Coal production in 1929, although higher than in 1928 and 1927, fell considerably short of the war-time maximum, while the production of oil, natural gas, and water power has increased enormously since the war.

In order to compare the several sources of energy it is necessary to reduce them to a common denominator. This is done in *Table I*, which shows the energy equivalent in British thermal units of each of the fuels. Water power is represented by the equivalent of the fuel necessary to perform the same work. The total of the energy from all sources is given in the last column of the table. For 1929, it amounts to 26,471 trillion B. t. u.'s, which is the greatest in the history of the country. Thus, while the consumption of coal has not advanced since the war, the total consumption of energy has increased.

It should be noted that the figures for "domestic oil" represent the entire production of crude petroleum. They include, therefore, not only energy used in the form of fuel oil under boilers, and therefore competing more or less directly with coal, but also the energy used in the form of gasoline, kerosene, and other refined products. Even these refined products involve a measure of indirect competition with coal, for the energy market of the country is becoming more and more fluid and competitive, and a demand which can not be met by one source of supply tends to fall back on the others. The purpose of these tables is to measure the total demand for energy.

TABLE I—ANNUAL SUPPLY OF ENERGY FROM MINERAL FUELS AND WATER POWER IN THE UNITED STATES

(Figures represent trillions of B. t. u.'s. Water power is represented by B. t. u.'s of coal necessary to produce the same amount of power)

Year	Anthracite	Bituminous coal	Total coal	Domestic oil (total crude including that refined)	Natural gas	Imported oil (total crude)	Total oil and gas	Total mineral fuels	Water power*	Grand total including water power
1859.....	262	158	419	†	.....	...	.....	419	¶	*
1869.....	464	415	879	25	.....	...	25	904	¶	*
1879.....	822	993	1,815	119	†	...	119	1,934	¶	*
1889.....	1,239	2,507	3,746	211	‡268	...	479	4,225	91	4,316
1899.....	1,643	5,065	6,708	342	‡240	...	582	7,291	135	7,426
1909.....	2,205	9,949	12,155	1,099	517	...	1,616	13,771	411	14,182
1913.....	2,490	12,535	15,025	1,491	626	102	2,219	17,243	588	17,831
1918.....	2,688	15,180	17,868	2,136	775	226	3,137	21,005	837	21,842
1919.....	2,396	12,206	14,602	2,270	802	317	3,389	17,991	892	18,883
1920.....	2,437	14,899	17,336	2,658	858	637	4,153	21,489	971	22,460
1921.....	2,461	10,897	13,358	2,833	712	752	4,297	17,655	908	18,563
1922.....	1,487	11,063	12,551	3,345	820	764	4,929	17,480	1,024	18,504
1923.....	2,539	14,791	17,330	4,394	1,082	492	5,968	23,298	1,136	24,434
1924.....	2,392	12,672	15,064	4,284	1,227	467	5,978	21,042	1,167	22,209
1925.....	1,681	13,625	15,306	4,582	1,278	371	6,231	21,537	1,290	22,827
1926.....	2,297	15,022	17,319	4,625	1,411	362	6,398	23,717	1,492	25,209
1927.....	2,179	13,565	15,744	5,407	1,553	350	7,310	23,054	1,687	24,741
1928.....	2,049	13,120	15,169	5,409	1,686	479	7,574	22,743	1,942	24,685
1929§.....	2,084	13,948	16,032	6,036	2,000	474	8,510	24,542	1,929	26,471

* No figures for water power are available prior to 1889. The fuel equivalent for water power is calculated from the reported horse power of installed water wheels assuming a capacity factor of 20 percent for manufactures and mines, and of 40 percent for public utilities, and assuming that the theoretical thermal equivalent of 1 hp. hour (2,547 B. t. u.) is 7 percent of the B. t. u.'s that would have been consumer in generating 1 hp. hour from fuels in practice. For 1919 to 1929, however, actual reports of the hp. hours produced by water in electric utility plants have been used as published by the United States Geological Survey. † Less than 0.5. ‡ Based on the amount of coal displaced by gas as estimated by the gas companies at the time. § Preliminary figures. ¶ No data.

Coal Division of A. I. M. E. Plans Interesting Session at Pittsburgh September 11 to 13

The Coal Division of the American Institute of Mining and Metallurgical Engineers is to meet in Pittsburgh September 11, 12 and 13. A program of subjects pertinent to anthracite and bituminous coal mining has been arranged, varying from underground mining practice to modern methods of burning coal and servicing and heating homes.

Sessions are to be held in the Cardinal room of the William Penn Hotel. The first session convenes at 9:30, the morning of September 11, with anthracite preparation as the topic for discussion. At the afternoon session bituminous preparation in all its varieties will be up for consideration.

On Friday morning, September 12, two interesting papers are scheduled: One by J. R. Campbell on "Evaluation of Coal for Blast Furnace Coke," and the other by H. V. Coes entitled "Solving Distribution Problems by Merger." The program for Friday afternoon includes a variety of topics—"Mechanical mining," by Eugene McAuliffe; "Coal Lands," by Frank Haas; "Stream Pollution," by R. D. Leitch; "Coal Mine Stoppings," by H. P. Greenwald and G. S. Rice; "Safety in Mining," by J. T. Ryan, and "Recovery of Ground Pillars," by Kenneth Lambert.

On Saturday, September 13, the following inspection trips have been arranged, and coaches will leave the William Penn Hotel at 8:30 a. m. There will be a charge of at least $1 per person for transportation.

1. Coal washing (100 tons an hour), by Simon-Carves machines, and by-product coking in 360 ovens; Jones & Laughlin Steel Corporation, Hazlewood, Pittsburgh.

2. Coal washing (900 tons an hour), by Rheolaveur system; Pittsburgh Coal Company, Champion, Steubenville Road.

3. Coal mixing; by-product coking in 70 ovens; use of by-product gas for heating ovens and cement kilns, excess gas sold; coke used in 700-ton blast furnace, whose gas is burned under boilers and slag is used for cement; coke breeze burned under boiler; excess power sold; wet cement process making 1,000,000 barrels a year; benzol and ammonium sulphate by-products; transportation by rail, river, and highway; Davison Coke and Iron Company, Neville Island, Pittsburgh.

4. Burning slack coal and pulverized coal in Colfax power station of Duquesne Light Company and in Springdale power station of West Penn Electric Company (in one boiler furnace of the latter the ash is slagged.)

Safety Education Through Mass Appeal

As the eighth in a series of reports based upon a study of the field of safety engineering, and designed to present the principles governing successful accident prevention work as well as tested methods of applying these principles, the Policyholders Service Bureau of the Metropolitan Life Insurance Company has just issued a report entitled *Safety Meetings*. In this are outlined methods of stimulating interest in safety through the enthusiasm aroused in such gatherings of employes and foremen.

The greatest reductions in industrial accidents have been made by those organizations which have conducted intensive safety educational programs among all employes. Because of the mass appeal involved, the conduct of employe and foreman safety gatherings has proven to be one of the effective activities on these programs.

The publication discusses the types of meetings which have been found most effective, together with suggestions for making them interesting and helpful to all concerned. A chart in the front of the report shows how the value of safety activities can be measured in terms of decreased accident rates. Industrial executives may secure copies of *Safety Meetings* by writing to the Bureau at 1 Madison Avenue, New York City.

Depletion Allowances

Additional allowances for depletion due to inadequate deductions claimed in tax returns caused over-assessment of $1,255,855 in internal revenue taxes in 1929, according to a report of the Joint Congressional Committee on Internal Revenue Taxation in passing on tax refunds for that year by the Internal Revenue Bureau. "This is another question of valuation based on judgment, the inherent defects of which, for tax purposes are apparent," says the committee. "These may be stated as lack of uniformity in computing depletion, due to exercise of individual judgment, lapse of time between the basic date and the examination of the return; inability to secure sufficient evidence to establish a correct valuation, and excessive expense to the Government and taxpayer." Reference is made to methods of simplification of depletion allowances as recently recommended in a report of the investigating staff of the committee.

Depreciation ranks third as the cause of over-assessments, amounting to $5,114,991. "The principal difficulties are 1913 valuations and rates of depreciation," the report says. "In many cases lump sums for depreciation are estimated and later more scientific rates based on the life and extent to which depreciable assets were used during the tax year are applied, resulting in additional allowances. The determination of depreciation, while it is a fact question, is primarily a matter of judgment. It is and will conitnue to be the cause of considerable controversy between the Government and taxpayer unless some arbitrary rule is devised which will be satisfactory. It is not impossible with low tax rates that some solution of the present difficulties may be found. The department should discourage changes in depreciation rates shown on current returns. The judgment of the taxpayer at the time of making the return on depreciation would be better than his judgment four or five years later when he makes application for a refund. Another matter is unsatisfactory in connection with the present depreciation method. Depreciation is allowed on cost or on 1913 value at a definite rate. In many cases, however, the plant account becomes simply a sum of money and depreciation reserves simply a sum of money, and the taxpayer keeps no adequate record of his plant in use. When this is true, the taxpayer, instead of reducing his plant account when items of equipment are discarded, keeps on depreciating his equipment, with the result that in place of getting 100 percent depreciation, he may get 200 percent. A complete report on depreciation is desirable."

Study of the Slacking of Coal

A study of the slacking tendency of coal is being conducted at the Pittsburgh Experiment Station of the United States Bureau of Mines. An accelerated test method is being applied to coals varying in rank from highest to lowest. By this method it is indicated that (1) bituminous coals show very little tendency to slack; (2) there is no close relation between slacking tendency and bed moisture; (3) in general, slacking increases with decrease in rank from high moisture bituminous coals to lignites.

Applications will be received by the Civil Service Commission until September 9 for appointment of junior metallurgists in the Government service at from $2,000 to $2,500 yearly salary. The duties will consist of general metallurgical work connected with the fabrication of manufactured articles, either ferrous or nonferrous; process control, physical testing of metallurgical materials or ores, microphotography and research work on a large variety of metallurgical problems. The optional subjects are physical metallurgy and recovery metallurgy. Competitors will be rated on practical questions on general metallurgy, and elementary physics and chemistry.

WITH THE MANUFACTURERS

Joy Manufacturing Company Wins Patent Suit

The Joy Manufacturing Company of Franklin, Pa., producers of mechanical loading machines, announces that the Court of Appeals of the Seventh Circuit has reversed the decision of the District Court in its suit against Herzler & Henninger Machine Works, manufacturers of the Wilson Loader, and has sustained the Joy Patent as valid and infringed by the Herzler & Henninger Machine Works.

A final injunction will issue in accordance with this decision enjoining further infringement.

Joy Coal Loaders are credited with r production of more than 50 percent of all mechanically loaded bituminous coal last year when compared with the total output of all types of loading machines employed by the industry.

Robins Company to Market Adams Chutes

The Robins Conveying Belt Company has been granted by the Adams Coal Machinery Co., of Plainfield, N. J., the right to manufacture and sell the Adams Avalanche Chute, the Withdrawal Chute, and their Floating Chute, to the different industries and operations where bulk materials such as coal, coke, stone, sand and gravel are handled. This right is very broad in the case of producers of anthracite and bituminous coal and of dealers; practically exclusive in the case of coke producers and dealers.

Briefly, this equipment is as follows:

The avalanche chute is the unit which moves material into a bin or silo in a series of masses. The material is eased rather than dropped into the pocket.

The withdrawal chute is the unit which unloads a pocket from the top rather than the bottom, thus maintaining a uniform mixture of all sizes.

The floating chute is the unit which loads trucks or cars from the bottom up without any dropping of the pieces.

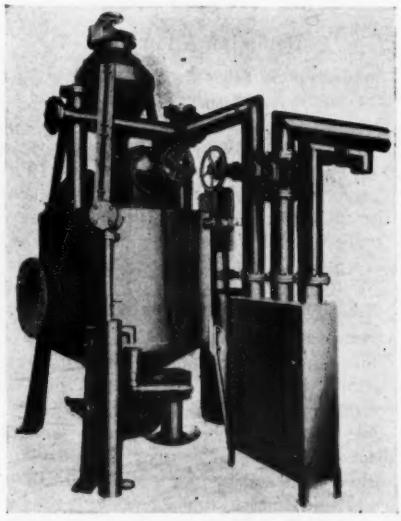
The Roller-Smith Company, New York City, announces two new additions to its instrument lines—the type PD pocket portable volt-ammeter, and the type HTD headlight tester. Both of these instruments are entirely new and incorporat many new and novel features of desig and construction.

Two Improved Types of Acetylene Generators

Oxweld Acetylene Company, 30 East 42d St., New York City, has placed on the market two improved types of non-automatic stationary acetylene generators for supplying large volumes of acetylene. These generators are each made in two sizes, having 500 lb. and 1,000 lb. carbide capacity. They are designed for large industrial plants where oxwelding and cutting are used extensively and where oxygen and acetylene are piped to stations convenient to operators.

The Oxweld type NA-3 Acetylene Generator, shown in the illustration, is for plants using low pressure welding and cutting apparatus and delivers to a storage holder which is weighted to supply acetylene to the shop piping system at a pressure of 20 in. water column.

In operation, the carbide is conveyed from the hopper to the generating chamber by a rotary feed screw driven by a



slow speed reciprocating water motor. The screw, being cast nickel, is very resistant to wear and will not cause sparks.

From the generator the gas enters the wash box where it passes through a water seal which acts as a scrubber to remove any particles of residue which might have been carried over. This device supplants the felt or hair filter usually employed. It has the advantage that it can not clog and cause abnormal back pressure or insufficient delivery to the holder. It thus insures a constant generating pressure.

When residue is being drawn off from the generator the wash box acts as a vacuum release and permits a reverse flow of gas which allows acetylene to return from the holder to the generating chamber to displace the drained water. When the generator is refilled with water, the gas passes from the generating chamber to the holder through this same wash box. The wash box is provided with an overflow which automatically limits the water level to give proper depth to the seal and to permit the functioning of the vacuum release during recharging.

The gas holder of suitable size may be located either inside or outside the generator house as best meets the needs of the particular installation. On the holder is mounted an automatic water holder shut-off which stops the carbide feed mechanism. When the gas bell approaches its upper limit, this shut-off must be opened by the attendant before the generator will again produce acetylene.

Except for this one automatic feature, all operations having to do with the starting and stopping of carbide feed must be performed by the generator attendant. For this reason, the generator is classed as non-automatic, that is, the carbide feed is not automatically governed by, or interlocked with the immediate acetylene requirements.

The type NA-4 Generator is similar to the type NA-3 with the addition of an Oxweld automatic booster system to deliver acetylene to the shop piping system at pressures not to exceed the permissible limit of 15 lb. per sq. in. The booster system consists of a booster pump, pressure regulating by-pass valve, pulsation tank, mercury seal, hydraulic back pressure valve, electric motor for driving the booster, and power transmission equipment. The booster unit may be had with a capacity suitable for the particular installation.

Heavy Duty Box Car Loader

Stephens-Adamson Mfg. Co., conveyor manufacturers of Aurora, Ill., have just published two attractively illustrated data sheets, giving descriptions and the specifications of their new heavy duty box car loader and also their standard loader that has been on the market for

some time. A new use is featured for these portable loaders. Not only are they used to fill box cars, but they will throw bulk materials far enough to distribute the cargo in the hold of freight boats.

One of these loaders was recently put on the end of the boom belt conveyor of a self-unloading freight boat and has worked beautifully, throwing material 30 ft. to 40 ft. beyond the usual discharge point.

Power Transmission Equipment Described

Two new publications pertaining to mechanical power transmission equipment for general industrial use have been issued by the Westinghouse Electric and Manufacturing Company.

Westinghouse - Nuttall Flexible Couplings is the subject of Circular 1887, which contains complete descriptions, capacities, dimensions, and weights of the different types. Illustrations include typical applications of each type.

Circular 1891, entitled Westinghouse-Nuttall Speed Reducers, Types SVR, DVR, and DVRA, contains full information about the application, construction, ratings, and dimensions of these vertical type units for single and double reductions and right-angle drives. Numerous existing applications of the different types are illustrated.

Copies of these publications are available upon request from any Westinghouse sales office or from the company's advertising department at East Pittsburgh, Pa.

Mine and Industrial Locomotive Publication

Baldwin-Westinghouse Mine and Industrial Locomotives is the title of a 28-page booklet, designated as Special Publication 1873, recently published by Westinghouse Electric and Manufacturing Company and the Baldwin Locomotive Works.

It contains a photograph, a drawing, and data covering the performance and the electric and mechanical construction of each of 17 mine locomotives and 7 industrial locomotives. These locomotives include both trolley and storage battery types.

Link-Belt Moves Into New San Francisco Plant

Link-Belt Company, Pacific Division, has just moved into their new manufacturing plant and office, located at Paul Avenue near Bayshore Highway, San Francisco, from their old plant in a different section of the city.

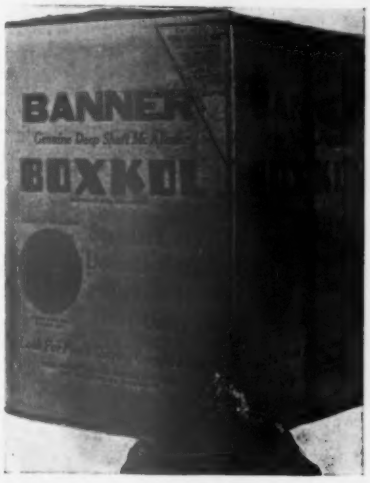
This added unit to Link-Belt's 16 plants and warehouses, located throughout North America, consists of a two-story office building of Spanish design; a warehouse 80 feet by 120 feet, three stories high; and the manufacturing building, containing the machine shop, steel shop, plant office and their auxiliary departments.

Within this plant, designed to enable Link-Belt to give quick, efficient service to their customers, is manufacturing all kinds of elevating, conveying and power transmission machinery.

A modern plant, employing the latest designs in tools, most up-to-date production methods, and maintaining an engineering organization capable of applying labor-saving machinery for every industry, is this larger San Francisco plant of Link-Belt Company, Pacific Division.

Domestic Coal Now Packed in Boxes at Mines

Operators and retail coal merchants have been watching with interest a new product known as "Boxkol," recently placed on the Southwestern market. It



appears to be the first successful attempt to load coal in cartons at the mines and ship the coal direct to the retailer ready to resell to the ultimate user.

This new product consists of 90 pounds of hand picked and mechanically cleaned nut, packed in an especially designed and patented carton, and sealed with a steel strap. The box, in addition to the tested specifications upon which it is built, has a special feature known as the "Scuttlebox" which permits the user to cut and fold one corner of the box and use it as a coal scuttle for emptying the coal. The steel strap may also be used as a handle.

In many sections where the tendency is to buy only a small quantity of coal this packaged product is meeting with instant approval of both dealer and consumer. The dealer is able to serve his "jitney" and "cash and carry" trade with a standardized quantity of coal, and as he does not have the usual loss in transit and waste from handling, can do so at a profit.

"Boxkol" was first placed on the market by the McAlester-Edwards Coal Company, of Pittsburg, Okla., in April, 1930. In less than three months this company had shipped five cars of the boxed product and booked orders for more than 40 cars for shipment in Kansas, Oklahoma, and Texas this fall.

"At first we thought the sale of such small quantities of coal would be confined to our immediate territory," said Jack J. Drew, sales manager of the company, "but 'Boxkol' is so popular it appears to be the coming way to sell coal and we have decided to nationalize the idea. We are working out a national advertising campaign and a license plan for other coal producers in various sections to prepare 'Boxkol' in our patented cartons and use our trade-mark on a royalty basis. Our plan is similar to Ethyl gasoline for refiners, whereby the producer and his retailers benefit from national advertising at a fraction of the cost."

Control for Reversing Small Motors

The General Electric Company announces a convenient reversing equipment for small motors, CR-7009-B-19. This switch is designed to handle squirrel-cage motors rated 1½ horsepower at 110 volts, and 2 horsepower at 220, 440, 550 and 600 volts, 25 to 60 cycles.

The switch consists of two contractors mechanically interlocked and having four sets of contacts and terminals. Three of these contact sets are for power circuits and the remaining one is for the holding circuit of the coil. The terminals are front connected and are marked to facilitate wiring.

The equipment is mounted on a compound base for mounting in an enclosing case. The case is suitable for wall mounting and has removable cover and knockouts for the incoming and outgoing leads. A three-button ("Forward," "Reverse," "Stop") push-button station is recommended for a control switch.

Fuller Lehigh Company Opens Sales Office at Atlanta

Announcement has been made by the Fuller Lehigh Company, manufacturers of pulverized-coal firing equipment and Bailey water-cooled furnace walls, of the opening of a new sales office in the Candler Building at Atlanta, Ga. Mr. J. Mc. C. Hill is in charge of the new office. The main offices and works of Fuller Lehigh Company are located at Fullerton, Pa.

Burton Explosives, Inc., to Enter Manufacturing Field

Concurrent with the filing of a deed covering 418 acres of land near New Castle, Pa., announcement is made of the entry of Burton Explosives, Inc., hitherto a sales organization, into the explosive and chemical manufacturing field.

J. S. Burton, president and general manager, formerly president of The Grasselli Powder Company, is quoted as stating that an initial production of 12,000,000 pounds of high explosives in 1931 is projected.

A plant to employ over 100 men is now under construction on the site of the former American High Explosives Company, of which Mr. Burton was general manager at the time of a merger of The Burton Powder Company with Grasselli in 1917.

Manufacture of a line of heavy chemicals is proposed as a development to follow the establishment of the explosive line.

Headquarters of the company are in the Guardian Building, Cleveland, Ohio.

Production is scheduled to start January 1, 1931.

Leaflet on New Weatherproof Oil Circuit Breakers

The Westinghouse Electric and Manufacturing Company recently published its Leaflet 20451, describing the new FO-22 Weatherproof Oil Circuit-Breaker, which is rated at 400, 600, and 800 amperes, 7,500 volts.

This publication describes in some detail the construction of this breaker, and this description is supplemented by photographs of the apparatus. The breaker is made for manual, d-c. solenoid, and a-c. rectox operation, and the leaflet describes these various operating mechanisms.

The breaker with its moisture and dust proof features is suitable for outdoor installation or for indoor service where there is a great deal of dust or moisture.

Roberts and Schaefer Contracts

New contracts closed by Roberts & Schaefer Company recently include the following:

Leccony Smokeless Coal Company, Besoco, West Virginia, Menzies Hydro Separator and coal washing equipment. Capacity, 50 tons per hour. To clean stove and pea coal.

Panther Creek Mines, Inc., Auburn, Illinois. Four track Marcus Tipple of steel construction. Capacity, 300 tons per hour. Load lump, egg, nut and slack.

Weyanoke Coal and Coke Company, Arista, West Virginia. Menzies Hydro Separator and coal washing equipment. Capacity, 75 tons per hour. To clean egg coal.

Youghiogheny and Ohio Coal Company, Meadowland, Pa. Four track Marcus Tipple of steel construction with loading booms and rock disposal machinery for preparing four grades of coal: lump, egg, nut and slack. Capacity, 325 tons per hour.

Ingle Coal Company, Littles, Indiana. Complete tipple with loading booms and Menzies Hydro Separator coal washing plant, to prepare four grades of coal: egg, stove, nut and slack. Capacity, 150 tons per hour.

How To Make Chain Drives Last Longer

Charles R. Weiss, chief engineer, Link-Belt Company, Indianapolis, Ind., in replying to a query recently, "How Can I Make My Chain Drives Last Longer," recommended the procedure outlined below:

"There are just five simple things for you to do to make your chain drives last longer.

"*First*—proper alignment. Be sure that sprocket wheels are in line on the shafts. If the sprockets are not exactly in line, a side pull develops which concentrates the load on the side of the sprocket teeth, and on one side of the chain. This faulty alignment results in excessive wear on both chains and sprockets.

"*Second*—proper adjustment. The chain should be run just a little slacker than a belt. Too much tension causes undue wear on the chain, and wasteful friction on the bearings. Not enough tension, of course, may allow the chain to jump the sprockets, or ride the teeth and break.

"*Third*—frequent lubrication. The chains should be lubricated at frequent intervals. A good grade of light cylinder oil should be used. A paint brush is a good thing for applying oil to the chain joints. Paint the open joints on open (upper) side. Oil the closed joint chains on inside (upper side of lower run) while drive is running slowly.

"*Fourth*—frequent cleaning. Open drives should be cleaned regularly. Take the chain off, and clean it well by soaking and dipping in kerosene. Dry well, and oil it thoroughly before starting up again. Before shutting down a machine for a period of time, clean the chain, and oil it with heavier oil or grease. When it is to be used again, re-clean and oil with light oil.

"*Fifth*—well-fitting sprockets. Last, but not least, look at the sprocket wheels from time to time to make sure that they are not worn enough to injure the chain. Before the teeth are worn to a hook shape, the wheels should be replaced with accurately made and close-fitting sprocket wheels.

"By giving only ordinary attention to your chain drives you make them last longer and run better, and also reduce the chances of a breakdown.

"If these recommendations are followed I am sure you will be time and money ahead and will get the best wear and service out of your machinery."

An air-operated portable sump pump which has been placed on the market by the Chicago Pneumatic Tool Company. It weighs but 44 pounds and has a capacity of 100 gallons per minute at a 28-ft. head. The manufacturers claim that steady capacities may be obtained up to 50 ft. No priming is required. It uses a 2½-in. water hose and a ¾-in. air line

The Denver Equipment Company, Denver, Colo., have recently completed a new bulletin, entitled "Results in Modern Flotation," which completely covers the science of flotation. The publishers have spared no expense in producing a booklet which contains much valuable information. The introductory part is devoted to a series of articles written by men who are outstanding in the flotation field. There are 14 pages of flowsheets, as well as two interesting articles which embody basic material on mill construction and estimating.

E. I. du Pont de Nemours & Company, Wilmington, Del., have issued a bulletin entitled "Brands of du Pont Explosives and Uses to Which They are Adapted," which is the sixth edition of a chart issued for the purpose of aiding users of explosives to avoid the purchase of unsuitable explosives and to select those which will give the best results in proportion to cost. The chart has been revised to include new explosives added to the list of du Pont brands during the past year.

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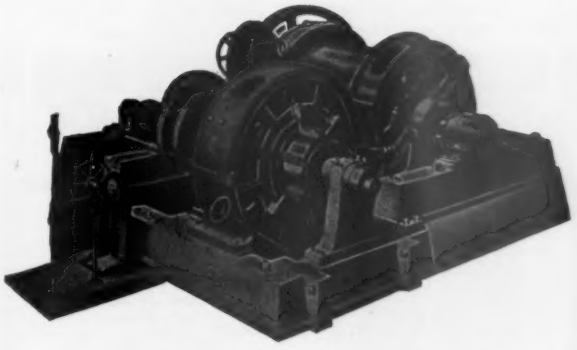

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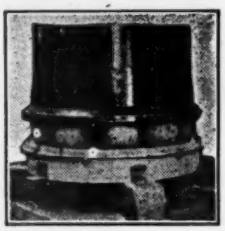

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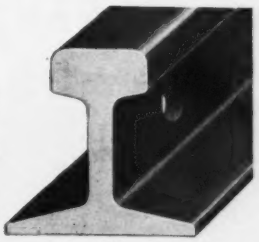

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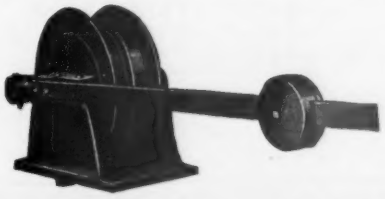

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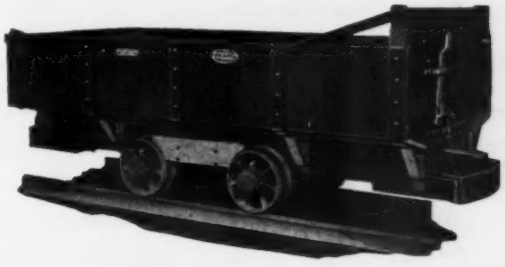

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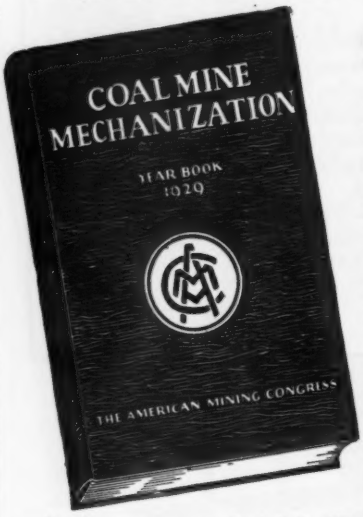

This book helps you to get the "breaks" in mechanization. Other men's experience is made available. The book pictures in detail the progress of this important phase of coal mining. It discusses and describes mechanization, its developments, its economical phases, its progress in the several fields in the United States and foreign countries; it carries the reports of the mechanization survey conducted by The American Mining Congress; it carries a brief illustrated description, impartially presented, of the loading and conveying equipment offered by the American manufacturers. There are discussions by authorities on safety, power, ventilation, and room and pillar recovery.

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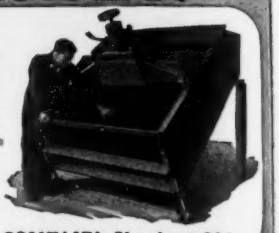

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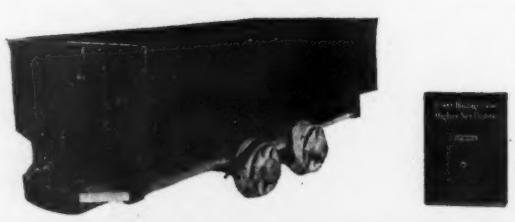

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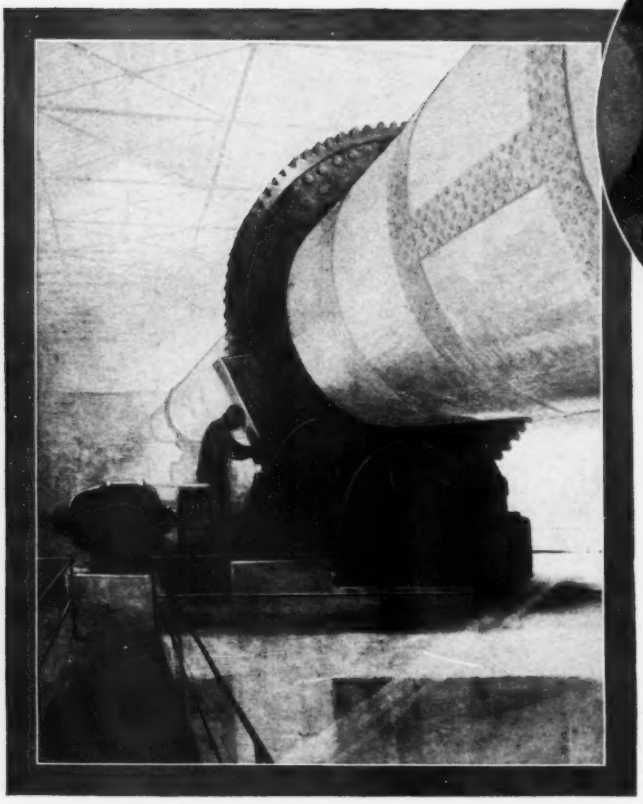

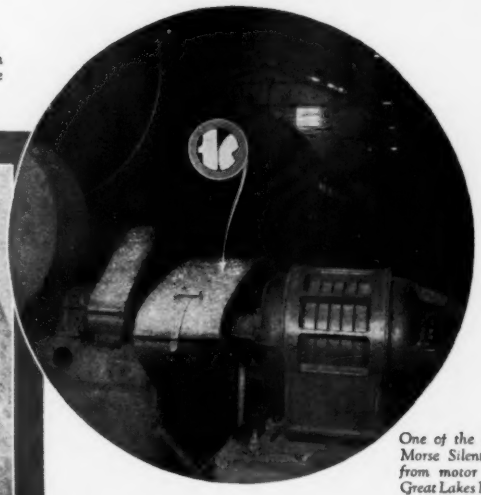

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